THE REFINER AND NATURAL GASOLINE MANUFACTURER

In This Issue

Various methods of refining with especial reference to cracked hydrocarbon oils. This is the second article on this subject by Jacque C. Morrell and Gustav Egloff, the first appearing in the July issue.

Will Fuel Oil prove the present panacea for Refiners? A staff article points out some of the possibilities of this product with the winter season approaching.

Handling hot oils in refineries brings up problems in pipe connections and valves. A thorough discussion of the valve subject is given by a recognized engineer.

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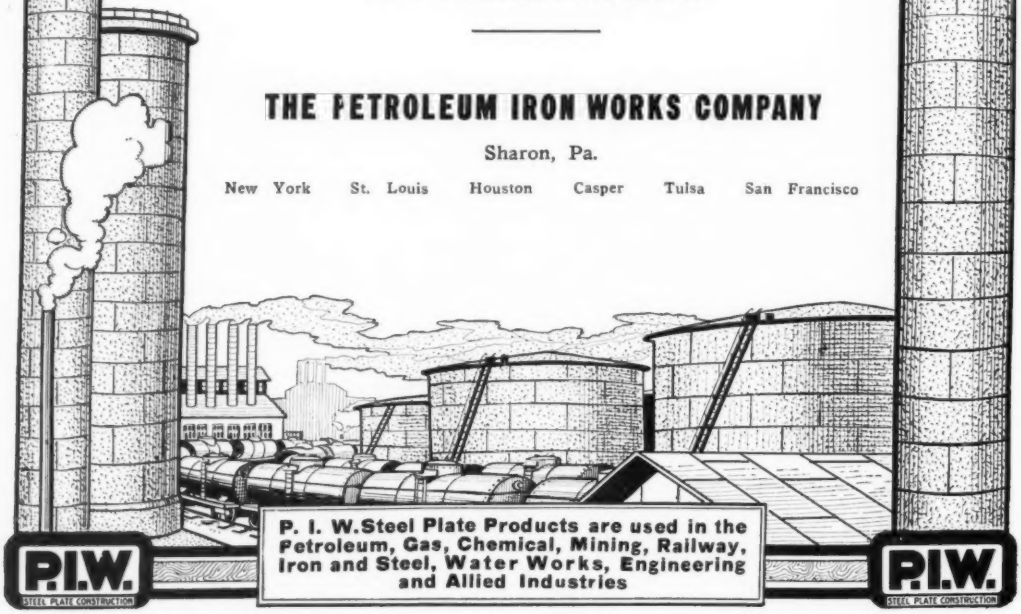

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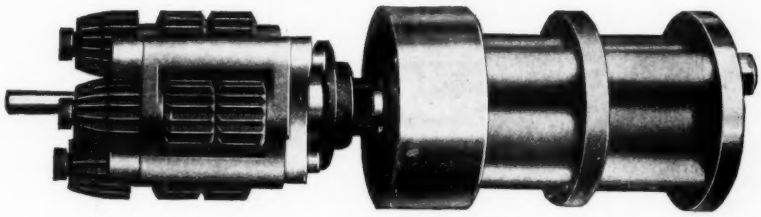

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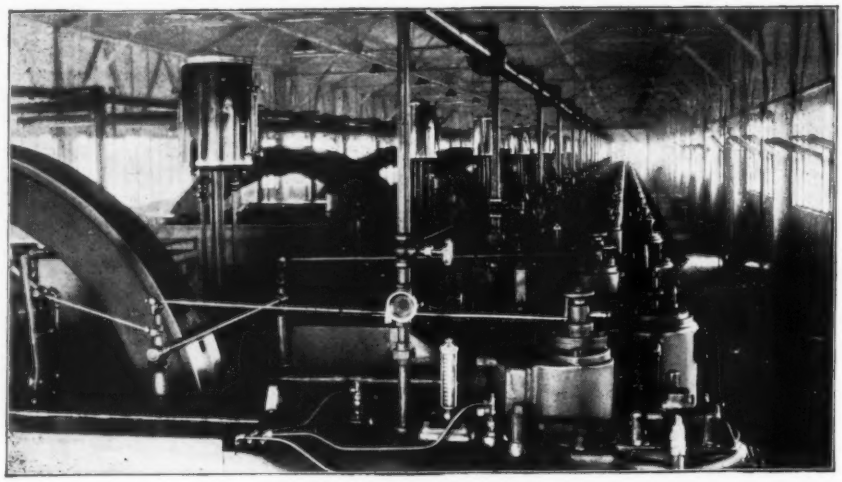

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The Various Methods of Petroleum Refining

Discussion of systems used with especial reference to cracked hydrocarbon oils

By Jacque C. Morrel and Gustav Egloff
Research Laboratories of the Universal Oil Products Company

IN A PREVIOUS paper upon the subject of refining cracked hydrocarbon oils the authors have already given their results upon the use of sulphuric acid as a refining agent with a complete development of the system proposed by them. The present paper will, therefore, be limited to such methods as those which do not make use of this reagent per se.

The refining of oils or more specifically the treating of oils to produce marketable products may be narrowed down to two general methods, namely physical and chemical. In the first general class are those methods which make use of adsorbents or solvents. In the second class are those which make use of chemical reagents. No attempt will be made here to give a full historical outline of the various methods of treatment which have been described in the literature, but a sufficient number of the processes proposed in the past will be indicated to give the reader an idea of the vast scope of the subject.

Adsorption or Colloidal Methods

In the purification of oils by adsorption or colloidal methods various finely divided solids or porous structure, such as Fuller's earth, adsorptive clays, artificial materials such as silicagel, and charcoals are made use of. Adsorbing agents when added to a solution remove from the latter a part of the solute. Under such circumstances the solute is increased in the surface layer when the surface tension is decreased by such increase in concentration. With cracked distillates it is not, however, believed that the coloring matter is in a state of true solution, but rather in a state of colloidal dispersion. The phenomenon of the removal of the dispersed particles is, however, the same.

Schultze[1] claims that the color in petroleum is due to an oleosol, of high molecular weight containing oxygen, sulphur and nitrogen. The mechanism of refining is a precipitation of resinous pitchy and asphalt material, held as colloids.

Condrea[2] on the other hand claims that refining is due to polymerization and oxidation by sulphuric acid of colored decomposition products formed during distillation. The compounds formed by such treatment are dissolved in the acid. He does not agree with the theory of precipitation of colloidal material.

Schulze[3] in reply to Condrea states that zinc chloride is a good polymerizing agent for unsaturated hydrocarbons and still does not have the same refining action that filtration thru Fuller's earth has.

Gurwitsch[4] has pointed out that adsorption can be accompanied by purely chemical processes such as the polymerization of unsaturated substances. For example amylene can be changed by the action of hydro-silicates, or charcoal to di-amylene and other compounds. Hexylene acts in a similar manner.

Phalen[5] states that the bleaching action of Fuller's earth is independent of its chemical composition and depends on the power of selective absorption. The following factors are given as the most important: Lengthening the column improves the bleaching action, using coarser earth increases the rate of flow, but decreases the bleaching action, increasing the temperature decreases the bleaching effect and increases the rate of flow, therefore, filtration should be carried on at the lowest temperature possible. The earth is burned at first at about 600 to 700° F. In this burning, water and organic matter are removed. After using the earth may be revivified by further burning at 1050 to 1100° F. Very serious loss in efficiency will result from over burning.

Rohland[6] points out a novel property of clays and states that the best clays are the dark plastic type containing the hydroxides of silicon, aluminum, iron and titanium as colloids. The clay is air dried pulverized and then mixed with water. It is stated that it is impermeable to chloroform, carbon-bisulphide petroleum ether and saturated hydrocarbons, but holds back unsaturated hydrocarbons of both the ethylene and acetylene series. Oxygen containing substances such as water and alcohol are taken up, whereas the oxygen free substances such as benzene and toluene are hindered.

Wesson[7] states that the efficiency of Fuller's earth can be determined only by actual test and that chemical analysis is of little value. The presence of soluble iron salts should be detected, these salts having an oxidizing action. This statement is made with reference to vegetable oils. He also states that bleaching is a function of the degree of hydration of complex silicates.

Guiselin and Handicourt[8] state that petroleum and its products on filtration through argillaceous earth undergo fractionation first. They further state that the dry earth has a strong affinity for petroleum compounds rich in carbon. Further that damp earth absorbs oil without changing it at all and that best results are obtained by filtration when the earth is granular, and for agitation when the earth is finely powdered. The latter brings in the surface effect.

The same authors[9] make the statement that the earth acts both by adsorption and by mechanical absorption and that unsaturated compounds seem to be strongly adsorbed.

Gilpin and Schneeberger [10] look upon petroleum as a two phase system that is, an emulsion in which the Fuller's earth acts as a dialyzing septum permitting free passage of paraffin oils and causing adsorption and coagulation of the bitumens, carrying with it sulphur and nitrogen compounds and the unsaturated hydrocarbons.

Wait[11] prepares colloidal membranes for filtering a liquid which is immiscible with water. The water in the membrane is removed by forcing through the membrane a liquid which is miscible both with respect to the water and the liquid to be filtered. As an alternate method the membrane may be soaked in such liquid. For example, in preparing a membrane for filtering gas-

[1]Schulze—Petroleum 5, 205, 446 (1910).
[2]Condrea—Petroleum 5, 832 (1910).
[3]Schulze—Petroleum 5, 1, 242 (1911).
[4]Gurwitsch—Zeit. f. angew Chem. 22, 1061-1070 (1909).
[5]Phalen—Chem. & Met. Eng. 21, 469 (1919).
[6]Rohland—Biochem. Z. 23, 278-80 (1910).
[7]Wesson—Mining and Eng. World 37, 667-8 (1913).
[8]Guiselin and Handicourt—Petroleum Rev. 27,
[9]Guiselin and Handicourt—Mat. Grasses. 5 2815-21, 2845-63, 2882-3 (1913).
[10]Gilpin and Schneeberger—Am. Chem. J. 50, 59-100 (1913).
[11]Wait—Brit. Pat. 144,961 (1919).

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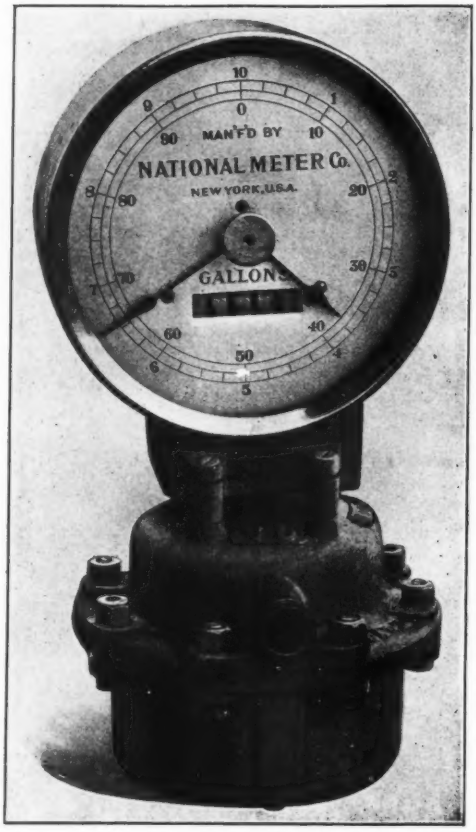

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oline the membrane is treated first with alcohol and then with benzene.

The materials used in the refining of oils by various adsorbing agents are manifold. In general the materials are of a porous structure, the pores being of the continuous type. Various earths and minerals such as Fuller's earth, china clay, kaolinite, alumina, bauxite, magnesite, iron oxide and various alkaline earth oxides, such as calcium oxide and magnesium oxide and other materials such as bone ash, bog iron ore, death valley clay, bentonite, silica-gel and various carbonaceous materials such as coke, coal, charcoals of various types, such as bone-black, wood charcoal, blood charcoal, etc., have all been used or mentioned in the literature as being used in connection with the refining of oils.

Silica-gel is a hard, semi-transparent, glassy substance, having the same composition as clear quartz.

It is differentiated from the latter material, however, by its porous structure and its non-crystalline nature and, of course, by the fact that it is artificially prepared.

The term gel only describes the product insofar as it is in the gel stage at one time during its preparation.

It is made by mixing in proper proportions and in a definite manner sulphuric acid with a solution of sodium silicate. The primary product thus formed is silicic acid. This silicic acid, which sets to a gel, is broken into pieces about one inch in size and thoroughly washed. It is then subsequently dried at a carefully regulated temperature, the final product having a volume of about 10% of the original. The final treatment, known as the activation treatment, is then applied removing any water contained in the product.

This material is said to possess superior qualities for refining oil, especially from the viewpoint of the selective removal of sulphur compounds.

Bentonite, a hydrated aluminum silicate containing various other minerals which has recently received considerable attention as a deinking agent also shows promise as a refining agent, as do also various artificially made activated charcoals.

The chief difficulty in the use of these materials, however, lies in their cost. Even so relatively cheap a material as Fuller's earth can not profitably compete with the sulphuric acid method of refining from an economic viewpoint. The problem of the use of such substances reduces itself to a consideration of the initial cost of the materials as well as to the proper working out of cheap and efficient methods of activating them so as to increase their life of usefulness.

These materials are used both in the liquid and vapor phase, either alone or in conjunction with other substances. For example Baynes and Fearenside[12] distill the hydrocarbons with powdered charcoal either as such or saturated with a solution of zinc chloride, the latter, of course, being dried first. Various other substances may be substituted for the charcoal. These materials may also be used in conjunction with the acid treat.

Burwell and Sherman[13] distill the oil vapors through iron oxide and alkaline earth oxides. Hall[14] passes the volatilized hydrocarbons through Fuller's earth. In cases like these the temperature of the adsorbing agents is kept above the condensing temperature of the oil.

Richter and Richter[15] and Harris[16] make use of ozone or oxygen and the former of air in conjunction with a treatment of the hydrocarbons with carbonaceous materials and other finely divided materials in the liquid phase. Whitman[17] makes use of a filter bed of bog iron ore, which he claims is cheaper and faster than Fuller's earth. He seems to have left out of consideration the specific nature of the materials used. Francis and Morgan[18] obtain water white products from petroleum hydrocarbons such as cracked distillate by treating the material with a saponaceous mixture or its equivalents, for example an alkali and a saponifiable fat containing an excess of alkali and distilling the mixture.

Some of the methods cited in the literature which bring in the factor of colloidal refining either alone or combined with chemical treatment are shown below.

Johnston[19] refines crude petroleum by distilling the latter in the presence of wood charcoal.

Van Wyck[20] makes use of a specially prepared charcoal from chalk and animal matter, such as glue, etc.

Lewis[21] filters petroleum distillates through a mixture of wood or coal ashes and charcoal in order to decolorize such distillates.

Field[22] first treats the oil with fuming sulphuric acid; dissolves the former in a suitable solvent and then treats with about 15 per cent of bone-black or other absorbing agent. The bone-black is then allowed to settle out and the clear solution run off. Treatment may be repeated, after which the naphtha is distilled off. This process may also apply to solid hydrocarbons.

Warren[23] treats the oil with special clays after the sulphuric acid treatment. The clay is sometimes mixed with magnesium carbonate. The treatment is especially beneficial for oils containing a high per cent of sulphur. The oil may be previously treated with a solution of lead acetate. The clay treatment may either precede or follow the sulphuric acid treatment.

Day[24] filters the distillate through a porous absorbent material such as palladium black or platinum sponge charged with hydrogen. The purpose of the latter is evidently to saturate the unsaturated compounds.

Hood and Salamon[25] treat dark colored oil with finely divided solids, such as alumina, magnesia, bauxite or other such materials in order to decolorize them. The process is one of filtration.

Schulz[26] removes organic acids from petroleum distillates by the use of dry calcium hydroxides, i. e., slaked lime. Acids, owing to the sulphuric acid treatment, are also removed in this manner. The oil is then filtered through a filter press.

Guyard[27] makes use of argillaceous earth or animal charcoal for filtering petroleum distillates. Filtering is carried on under pressure.

Wohle[28] treats the oils with an alkaline solution and a vegetable saponaceous mixture.

Richter and Richter[29] mix the material to be treated with finely divided active carbon and bring the mixture in intimate contact with gases containing oxygen. The latter is supposed to bring about the oxidation of sulphur and nitrogen compounds, which are carried away as gases.

Gad[30] makes use of filtering agents, such as aluminum oxide. The heavy oils are first dissolved in some solvent, such as benzine. The filtering material is then regenerated by extraction with benzine or ether and then ignited.

St. Hamilton[31] emulsifies the hydrocarbon material first. The resulting emulsion is then allowed to pass into layers from which the lighter oil is drawn off and forced through a filter into a distillation apparatus and then distilled.

Lasher[32] after treating the oil with acid and alkali, passes the former through ashes of rice hulls.

Richter[33] mixes the oil with a solution of sodium hydroxide and separates the latter by settling. After adding finely divided ashes of calcined clay the oil is then mixed with a catalyst containing active carbon in admixture with calcium oxide and then treated with air.

Chappell and Moore[34] heat a mixture of petroleum oil and finely divided decolorized material, after which the oil is immediately cooled and separated.

In the preparation of a clay for the treatment of oil Stratford[35] treats the clay with acid and then removes the acid by washing. The material is then dried and crushed. The clay is regenerated by treatment with naphtha, thickening, washing and drying.

Leslie and Barbre[36] heat oils to the boiling point with a porous catalyst, such as coke, charcoal or Fuller's earth. The catalyst is then filtered out and the residue is distilled to separate the oil from resins formed during the process. Various alkaline substances may be added with the catalyst.

The De Laval Separator Company [37] in purifying gasoline which has been used in dry cleaning agitate the gasoline with a strong alkali and separate the resulting emulsion by centrifuging the latter.

Smith[38] heats oils under a pressure of 100 to 150 pounds per square inch in the presence of an absorbent such as cotton waste saturated with a strong solution of an alkali carbonate or bicarbonate.

In general in the application of the colloidal method of refining some form of filtration is resorted to, either the column or filter press method or the oil is distilled with the adsorbing agent or the vapors of the oil distilled through the adsorbing agent.

In the use of the filter press method the entire content of the oil is decolorized to the same extent, however, with the filter column the efficiency of the column falls off, depending upon the amount of the oil passed through so that the decolorization of the filtrate gradually diminishes, the last portions coming through being somewhat colored.

Regarding the regeneration of adsorptive materials in general they are subjected to the action of some extraction agent such as benzine, usually by continuous circulation of the solvent

---

[12]Baynes and Fearenside—Brit. Pat. 5, 208 (1883).
[13]Burwell and Sherman—U. S. Pat. 738,656 (1903).
[14]Hall Motor Fuel Company—Fr. Pat. 483,231 (1917).
[15]Richter and Richter—Fr. Pat. 421,277 (1910).
[16]Harris—Brit. Pat. 22,430 (1906).
[17]Whitman—U. S. Pat. 1,312,375 (1913).
[18]Francis and Morgan—U. S. Pat. 1,313,629 (1919).
[19]Johnston—U. S. Pat. 31,982 (1861).
[20]Van Wyck—U. S. Pat. 65,313 (1867).
[21]Lewis—U. S. Pat. 42,671 (1864).
[22]Field—Brit. Pat. 10,139 (1886).
[23]Warren—Brit. Pat. 1,014 (1901).
[24]Day—U. S. Pat. 826,089 (1864).
[25]Hood and Salamon—Brit. Pat. 16,617 (1908).
[26]Schulz—Petroleum 5, 86-90 (1909).
[27]Guyard—Fr. Pat. 472,195 (1914).
[28]Wohle—Brit. Pat. 23,348 (1909).
[29]Richter and Richter—U. S. Pat. 1,098,763 (1910).
[30]Gad—Chem. Tech. Ztg. 28, 143 (C. A. 5, 193) (1911).
[31]St. Hamilton—Fr. Pat. 442,801 (1912).
[32]Lasher—U. S. Pat. 1,075,481 (1913).
[33]Richter—U. S. Pat. 1,098,764 (1914).
[34]Chappell and Moore—U. S. Pat. 1,404,374 (1922)
[35]Stratford—U. S. Pat. 1,408,655 (1922).
[36]Leslie and Barbre—U. S. Pat. 1,337,523 (1920)
[37]De Laval Separator Company—Brit. Pat. 142,089 (1920).
[38]Smith—Brit. Pat. 153,844 (1920).

DISTILLATION OF CRACKED HYDROCARBON OIL WITH VARIOUS SOLIDS

Beaume Gravity	47.7	47.7	47.7	47.7	46.0	46.0	47.0
cc's Used	500	300	300	300	400	1500	300
Init. B.P.°F.	77	78	76	78	90	86	78
Original Color	Dark Yellow	Dark Yellow	Dark Yellow	Dark Yellow	Dark Yellow	Dark Yellow	Dark Yellow
cc's Gasoline	180	180	180	180	160	600	180
Per cent Gasoline	60	60	60	60	40	40	60
Color Gasoline	Water White	Dark Water White	Very Light Yellow	Water White	Water White	Water White	Very Light Yellow
Odor Gasoline	Good	Fairly Good	Slightly Improved	Fairly Good	Fairly Good	Fairly Good	Slightly Improved
Treating Material	Death Valley Clay	Death Valley Clay	Death Valley Clay	Fuller's Earth	Fuller's Earth	Fuller's Earth	Used Bone Black
Per cent (by wt. of oil)	5.0	2.5	1.0	5.0	4.0	3.5	5.0
Grams Used	11.8	5.9	2.4	11.8	12.728	41.4	11.8
Per cent Over	60	60	60	60	40	40	60

and dried and burned. With regard to the burning of the various hydrosilicates great care must be exercised to prevent over burning. Not only will part of the water of constitution which is necessary to the structure of the material be driven off, but, also, incipient fusion, melting and sintering of the particles may take place.

For certain phases of the petroleum industry no substitutes have as yet been found for some of the above named products. As examples of these may be mentioned the preparation of various lubricating oils, paraffin, vaseline, vaseline oils, etc.

In the present work as low a quantity as 3½ per cent of Fuller's earth or death valley clay gave a water white product when shaken and filtered or distilled with cracked gasoline (Table 1). The odor was not, however, removed to any great extent, and the odor of the extracted coloring matter was aromatic if anything. Chemical investigation of this coloring matter indicates it to be a terpene-like body. This work will be reported upon in a later paper.

In some cases as mentioned previously a combination coloidal and chemical treatment is given, the chemical treatment preceding the treatment with the adsorbent. As, for example, a sulphuric acid treatment followed by filtration through Fuller's earth with subsequent distillation, the latter playing the double role of neutralizing the acid and removing certain coloring constituents. Water white products have been obtained in this manner.

The phenomena of adsorption has been known for a long time, e. g., the decolorizing action of charcoal has been known since 1791. (Bancroft)[39].

The phenomenon of adsorption can be represented approximately quantitatively by the adsorption isotherm $(x/m)n$ equals kc where x and m represent the amounts of material adsorbed and the solid adsorbing agent respectively, c the concentration of the dissolved material and n an exponential function greater than unity.

Adsorption is a phenomenon depending on a great many specific conditions, the most important of which are probably the nature and quantity of the adsorbing agent and the adsorbed material.

That some chemical action takes place in selective adsorption is shown by the fact that if a solution of sodium chloride is filtered through Fuller's earth the filtrate is acid to litmus or phenolpthalein (Bancroft loc. cit.) owing to the selective adsorption of the base.

It has been definitely shown in this laboratory that Fuller's earth exerts a chemical as well as physical effect in the refining of cracked hydrocarbon oils.

According to various writers very little is known about the coloring material in petroleum distillates, and less is known about the coloring material in cracked hydrocarbon oils.

Brooks[40] states that it is improbable that the coloring matters in petroleum distillates are hydrocarbons, since there are but few colored hydrocarbons known. The same author points out that fluorescence is regarded by some writers as being due to particles of sulphur, carbon or other substances in a colloidal state of dispersion.

Brooks and Bacon[41] have shown that fluorescent substances in petroleum are readily sulphonated by ordinary sulphuric acid to give water soluble sulphonic acids also possessing fluorescence.

Work is in progress in this laboratory on the subject of coloring materials in cracked hydrocarbon oils, and an interesting report will soon be made upon such materials.

Solvent Refining

Another physical method of refining is by selective solubility; as a rule such a solvent is used so that two layers are formed and the distribution of various components of the oil between the two phases follows the law of partition or solubility distribution namely, $\frac{C_1}{C_2} = K$ (Constant). Where C_1 is the concentration of the substance in the first phase and C_2 in the second phase, the assumption being made that no molecular association takes place. It can be shown theoretically that the amount of materials extracted will be greater with several successive extractions, than with a single extraction. For the most part alcohols and liquid sulphur dioxide have been used as solvents to date.

The liquid sulphur dioxide method was developed commercially by Edeleanu[42]. In general the aromatic and olefin hydrocarbons are soluble in liquid sulphur dioxide. Naphthenes, which the literature states are insoluble, may be completely dissolved in sufficient quantity of the solvent, according to Moore, Morrell and Egloff[43]. These authors have found that: (a) Within certain limits of concentration aromatics may be separated from paraffins or naphthenes; (b) olefins may be separated from paraffins or naphthenes; (c) aromatics and olefins together may be separated from paraffins or naphthenes; (d) napthenes may be separated from paraffins.

One of the advantages of this method is that the valuable unsaturated hydrocarbons may be recovered. Other advantages are the low cost in material and the ease in which the two fractions of the original oil can be completely freed of solvent. No work, as yet, has been reported upon the use of liquid sulphur dioxide as an agent for refining cracked distillates, and work to that end is now in progress in this laboratory and will be reported upon shortly.

It may be said that neither the adsorption method of refining or the use of solvents can as yet compete commercially with the sulphuric acid method.

Regarding the use of various other solvents for petroleum refining the following may be pointed out:

Landsberfi[44] extracts hydrocarbon oils with burning oils with strong denatured alcohol and obtains a product which is deprived of its disagreeable odor and smokiness.

Fabbri[46] makes use of naphtha or light oils as a solvent for various types of hydrocarbons before treating. In some cases naphthalene is added to the naphtha. The oil is then treated as usual with sulphuric acid, washed and filtered, the solvent being removed finally.

Peroff[47], Cobb[48] and Robinson[49] subject oils which have been treated with sulphuric acid to the solvent action of various alcohols in order to remove the sulphuric acids from the oil. Petroff[50] treats with methyl alcohol, acetone and other solvents. Cobb and Robinson[51] both make use of isopropyl alcohol as a solvent. In an earlier process making use of solvents, Cobb subjects the oil, after a sulphuric acid treatment followed by an alkali treatment, to an extraction with 5 to 10 per cent of glycerol, in order to remove the sulfo-acid-salts.

Humphreys[52] neutralizes the oil after a treatment with sulphuric acid, and extracts sulphonic acid or salts of the same, with a dilute solution of alcohol.

Paris[53] compresses the vapors of petroleum distillates to be refined with such gases as hydrogen in the presence of gylcerol.

Mann and Chappell[54] treat petroleum oils direct with alcohol at a very low temperature in order to extract impurities.

Chemical Methods of Refining.

The methods making use of various chemical reagents are so numerous that a detailed description of them would be far beyond the purpose of this paper.

[39] Bancroft—"Applied Colloid Chemistry," McGraw-Hill (1921).
[40] Brooks—"The Non-benzenoid Hydrocarbons" Chem. Catalog. (1922).
[41] Brooks and Bacon—"J. Ind. Eng. Chem. 6,623. (1914).
[42] Edeleanu—Rev. d. Petrol. (20) Petr. 5, 383-4 Bull., A. I. M. E., 93, 2313, (1909), (1914).
[43] Moore, Morrell & Egloff—Chem. and Met. 18, 8 (1919).
[44] Landsberg—Ger. Pat. 166,452 (1904).
acetone or its homologues. Guttmann[45] treats
[46] Guttman—Fr. Pat. 373,072 (1906).
[46] Fabbri Brit. Pat. 21,153 (1909).
[47] Petroff—U. S. Pat. 1,087,888 (1914).
[48] Cobb—U. S. Pat. 1,315,623 (1919).
[49] Robinson—U. S. Pat. 1,387,868 (1921).
[50] Petroff—Brit. Pat. 19,676 (1914).
[51] Cobb—U. S. Pat. 1,387,835 (1921).
[52] Humphreys—U. S. Pat. 1,286,179 (1918).
[53] Paris—U. S. Pat. 1,405,156 (1922).
[54] Mann and Chappell—U. S. Pat. 1,163,025 (1915).

In order to give an intelligent abstract of all the various methods in use would require a separate volume in itself. This phase of the subject is particularly complexed by the fact that the various processes described in some cases make use of over one-half dozen or more reagents used under particular conditions and in a particular order of treat. Further, in most cases the methods are of an arbitrary and empirical nature, the results of which must be put to the test in order to properly evaluate them. However, the attempt will be made at least to indicate some of the various methods used in this connection.

A great many of these various chemical methods of refining aim at the removal of sulphur from the oil. A description of particular methods used for the latter purpose will be made in a separate section, although it is to be borne in mind that a great many of the methods indicated in the reference immediately following have for their purpose, at least in part, the removal of compounds of sulphur.

Roth[55] treats lubricating oils with potassium permanganate during the process of distillation in order to free them from substances which are liable to resinify. The distillate is first agitated with sulphuric acid and then with sodium hydroxide of certain concentrations.

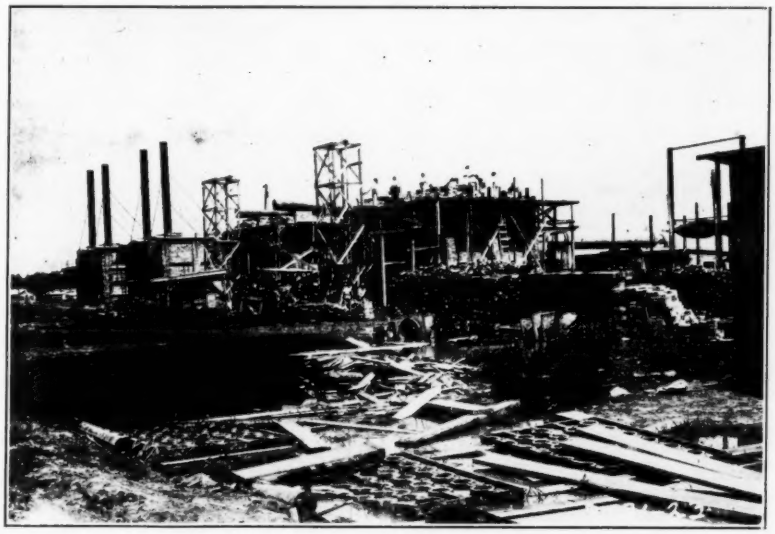
Burton[56] treats oils with sodium peroxide, acidulating the oil previously with acids in order to cut down the violence of the reaction. Schrader[57] distills oil with phosphoric or boric acids, or salts of these acids together with sulphuric acid, claiming the destruction of resinous compounds.

Macalpine[58] makes use of a so-called acetylene preparation of manganese prepared by the action of acetylene on alkaline earth oxides or carbonates in water, subsequently adding potassium permanganate.

Michler[59] recommends the use of alkaline silicates either alone or with alkaline substances for neutralizing the oil after the acid treat. The claim is put forth that the precipitated silica or silicic acid assists in the refining action.

Stewart and Wallace and Cowell[60] employ sodium or potassium permanganate and manganese dioxide, preferably with the use of sodium or potassium hydroxide. The oil is distilled with these reagents.

Stewart and Wallace[61] make use of solutions of potassium permanganate and aluminum sulphate, perferably mixed and then agitates with steam or air. Various other reagents such as sodium chloride, nitric acid, nitrous acid and iron sulphate are made use of previous to the treatment with the above named reagents.



Showing four of the 26 units of the Cross Cracking process being placed in the 20,000 barrel daily capacity refinery under construction by the Humphreys Pure Oil Company at Smiths Bluff, Texas, on the Coast. This new plant is scheduled to be ready for operation by the first of the coming year, and when completed will represent an investment of approximately $3,500,000

Charitschkoff[62] makes a preliminary treatment with lime in order to neutralize any free acids which are present and claims in this manner to effect the saving of alkali subsequently used to neutralize the sulphuric acid used in treating.

Rutgerswerke[63] heats the oil with hydroxides or oxides of heavy metals or with solutions of salts of these heavy metals preferably in the presence of an alkali, and then passes steam into the mixture. They also make use of aldehydes or ketones instead of the heavy metal compounds.

Vittenet[64] treats with sulphuric acid then with sodium bisulphite, and finally dries the oil over calcium carbide.

Amend[65] Removes hydrogen sulphide from the oil by blowing with steam or air after washing, and then treats with a solution of a soluble carbonate. The latter may be followed by a treatment with ferrous sulphate solution.

Amend[66] also makes use of an alkali, later agitating with copper sulphate.

Goffart[67] decolorizes and deodorizes oil by agitation with a dilute solution of ferric chloride and hydrochloric acid. Goffart also makes use of metallic powders such as zinc which acts catalytically and at the same time as a reducing agent. He claims that the coloring matter is decomposed and the unsaturated compounds are reduced.

Macalpine[68] makes use of sodium chloride and sodium carbonate in a saturated solution.

Deichler and Lasser[69] use metallic sodium, claiming catalytic action as well as the formation of soluble sulphides.

Wynne[70] in refining oils makes use of such reagents as carbon, borax, soap, naphthalene, camphor, alum, borax, pearlash, soda-ash, lead acetate, sulphur and hydrochloric acid. On one type of treatment, the oil is treated with an air blast, filtered and then treated with a blast of ozonized air. Potassium chloride and naphthalene are then mixed with the oil, which is finally treated with an air blast.

Charitschkow[71] follows the sulphuric acid treatment with about 4 per cent of potassium oxalate by weight of the oil.

Macalpine, Simmance and Abaday[72] after agitating the oil with sodium carbonate distill the former, then treat with sulphuric acid and finally reflux with manganese dioxide.

Wynne[73] adds a mixture of a saturated solution of borax and alum and then sulphuric acid to the oil finally blowing air through the mixture.

Fama[74] very thoroughly mixes the oil with oxidizing agents such as potassium dichromate, potassium permanganate, barium dioxide, chloric acid, chlorates, per-chlorates and treats with sulphuric acid. He claims the formation of a small amount of ozone, and gives as an alternate method the use of ozone directly.

Claussen and Cobbett[75] claim a purification of the oil by the use of successive treatment with finely divided metallic lead or iron, sulphuric acid and lime. The oil is then mixed with a light distillate and distilled, in some cases, in the presence of naphthalene.

Stiepel[76] dissolves the oil in a neutral solvent and oxidizes with ammonia persulphate, hydrogen peroxide or nitric acid. The impurities are then filtered out, and the solvent distilled off.

Sprenger[77] distills oil with lye and a suitable metal.

Kamo[78] treats the oil with seawater to which vinegar has been added.

McAfee[79] refines oils with anhydrous aluminum chloride. Anhydrous aluminum chloride makes a very good refining agent, decomposing sulphur and other objectionable derivatives. A stable product of good color is obtained.

Fabbri[80] successfully treats with sulphuric acid, allows the treated oil to stand 24 hours and after decantation washes with milk of lime and finally with sodium chloride and water. The final treatment is given with a 1 per cent solution of naphthalene dissolved in toluene.

Giesberg[81] uses nitric and sulphurous acids in suitable quantities.

Brown[82] makes use of red phosphorous in refining oils.

Black[83] treats with sulphur tri-oxide in admixture with diluting gases, the latter consisting of nitrogen and oxygen.

Wohle[84] treats the oil with an alkaline solution containing iodine and various soapy substances also making use of a sulphuric acid treatment in conjunction with the former.

Knottenbelt[85] makes use of nitrogen dioxide, ferrous sulphate, sulphuric acid and finally Fuller's earth.

Davis and Richards[86] mix the oil with a suitable oil of mineral or vegetable origin then with sulphuric acid.

Baumgartel[87] passes the hydrocarbon first through fine sieves and then through a mixture of sodium hydroxide with an ammonia salt. The generate ammonia produced in this way has refining properties which is said to produce a product possessing superior qualities.

Hellman[88] mixes the petroleum with one-third of its bulk of dilute sulphuric acid and adds oxidizing agents such as lead peroxide, manga-

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[55]Roth—Ger. Pat. 30,786 (1884).
[56]Burton—Brit. Pat.. 963 (1894).
[57]Schrader—Brit. Pat. 15,323 (1894)
[58]Macalpine—Brit. Pat. 10,391 (1899).
[59]Michler—Chem. Ztg. 21. (82), 853 (1897).
[60]Stewart & Wallace and Cowell—Brit. Pat. 9,796 (1900).
[61]Stewart & Wallace—Brit. Pat. 10,629 (1901).
[62]Charitschkoff—Naphtha 9(11) 211-13 (J. S. C. I. 1901, 885). (1901).
[63]Rutgerswerke—Fr. Pat. 324,938 (1902).
[64]Vittenet—Fr. Pat. 329,076 (1903)
[65]Amend—U. S. Pat. 747,348 (1903)
[66]Amend—U. S. Pat. 764,099 (1904).
[67]Goffart—Fr. Pats. 350-091-342,588 (1904).
[68]Macalpine Brit. Pat 28,243 (1904).
[69]Deichler and Lesser—Ger. Pat. 160,717 (1904).
[70]Wynne—Brit. Pat. 26,198 (1905).
[71]Charitschkow—Chem. Ztg. 30, Rep. 35. (1906.)
[72]Macalpine, Simmance and Abaday.—Brit. Pat. 11,893 (1905).
[73]Wynne—Brit. Pat. 2,314 (1907).
[74]Fama—Fr. Pat. 376,601 (1907).
[75]Claussen & Cobbett—Brit. Pat. 16,593 (1907).
[76]Stiepel—Petr. 5, 1020 (1920).
[77]Sprenger—Brit. Pat. 3,074 (1909).
[78]Kamo—Brit. Pat. 11,359 (1909).
[79]McAfee—U. S. Pat. 1,277,328 (1918).
[80]Fabbri—Brit. Pat. 27,714 (1909).
[81]Giesberg—Brit. Pat. 2,901 (1910).
[82]Brown—U. S. Pat. 1,234,862 (1917).
[83]Black—U. S. Pat. 968,640 (1910).
[84]Wohle—Fr. Pat. 414,928 (1910).
[85]Knottenbelt—Fr. Pat. 411,780 (1910),
[86]Davis & Richards—Brit. Pat. 16,908 and 19,-081 (1911).
[87]Baumgartel—Ger. Pat. 228,260 (1909).
[88]Hellmann—Brit. Pat. 475 (1911).

nese dioxide, chromium tri-oxide and ferric oxides.

de Fazi[89] treats with sulphuric acid and then distills in the presence of slaked lime.

Rutgerswerke[90] treats oils with alkali in a kneading machine.

Chem. Fab. Westend[91] treats with fuming sulphuric acid and then with alkaline earth metals.

Hamilton[92] mixes hydrocarbon liquid with a saline solution and the resulting emulsion is subjected to a jar or vibration, subsequently mixed with air and the mixture forced through a cleansing agent.

Melamid[93] distills the oil with phosphoric acid. In conjunction with Grotzinger[94] he later makes use of phosphoric acid, pyro-phosphoric acid and phosphorous acid. The oil vapors either alone or in the presence of an inert gas are passed through the acid.

Guillard[95] first dilutes the oil to be treated with a lighter oil. It is then subsequently treated with magnesium chloride which precipitates the tar and finally a treatment with zinc chloride is given which is supposed to remove any remaining tar.

Hense[96] adds gums or resins and an oxidizing agent and distills up to 200 to 350°. Ozone is then passed through the cooling liquid, the sediment is removed and the distillation continued.

Myers[97] agitates heavy hydrocarbon oils with lime water then with alum. The mixture is allowed to settle, and the aqueous layer is drawn off and the residual oil filtered.

Soc. Le Terebinto[98] treats oil successively with sulphuric acid, fuming sulphuric acid, powdered aluminum chloride, calcium aluminum chloride and dilute solutions of sodium hydroxide.

Schering[99] makes use of inorganic chlorides in order to condense the unsaturated hydrocarbons.

Herber[100] mixes the oil with calcium oxide and distills with a current of air or steam.

Dehnst[101] adds 3 per cent of sulphur to the oil distillate and distills the latter.

Wohle[102] makes use of mucilage and a solution prepared from soap bark and soda lye in conjunction with the sulphuric acid treat.

Allgem. Chem. Ind.[103] treats cracked oil with heavy metal salts having a condensing action to free from mal-odorous and resinous substances. Salts such as stannous chloride, zinc chloride, ferric chloride and copper sulphate are used. Allgem. Ges. f. Chem. Ind[104] treats distillates with salts of heavy metals which converts resins into residue at the next distillation.

Barnickel[105] treats crude petroleum containing not less than 10 per cent of water and slimy substances by emulsifying with the oil a solution of iron sulphate. The oil is then drawn off from the top layer.

Skidmore and Conerty[106] agitate the oil to be treated with an aqueous mixture of alkali phosphates by passing air through the mixture.

Dunstan[107] distills cracked oils in the presence of anhydrous aluminum chloride, and obtains very good products.

Nelson[108] treats oils having a disagreeable odor or a yellow to brown color with an unsaturated fatty acid with or without phosphoric acid. The oil may be mixed with linseed oil and the mixture distilled or the oil may be passed in the form of a vapor through a heating chamber containing pumice with linseed oil on its surfaces and through another chamber containing phosphoric acid and pumice.

Ruff[109] treats oils with sulphuric acid containing 1 per cent or less of nitric acid.

Grissard[110] uses various anhydrous alkali carbonates with other drying agents to remove traces of water from oil.

Torossian[111] states that stannic chloride precipitates the asphaltic and resinous substances as well as certain sulphur compounds from crude petroleum and its distillates. He cites this as a test to show the extent to which refining has taken places.

DISTILLATION OF CRACKED HYDROCARBON OIL WITH VARIOUS CHEMICALS

Baume Gravity	47.7	47.7	47.7	47.7	47.7
cc's Used	500	500	500	500	500
I. B. P. °F.	74	77	77	66	72
Original Color	Dark Yellow	Dark Yellow	Dark Yellow	Dark Yellow	Dark Yellow
cc's Gasoline	300	300	300	300	300
Per cent Gasoline	60	60	60	60	60
Color Gasoline	Light Yellow	Light Yellow	Dark Yellow	Light Yellow	Light Yellow
Odor Gasoline	Bad	Bad	Slightly	Bad	Bad
Treating Material	None	Arsenic	Improved Sodium Hydroxide	Calcium Oxide	Ferric Oxide
Per cent (By wt. of oil)	None	10	10	10	10
Grams Used	None	39.39	39.39	39.39	39.39
Per cent Over	60	60	60	60	60

Distillation of cracked distillates with various chemicals for the purpose of studying the effect of these reagents on the color and odor gave results of a negative character. These reagents all in the solid state were selected from the viewpoint of a possible reaction with the sulphur compounds in the oils. In the case of the arsenic some arsenic sulphide was formed, but the resulting product was even worse in odor than the original and quite yellow in color possibly owing to the presence of colloidal arsenic sulphide. Some improvement was noted with the sodium hydroxide.

According to Knibbs[112] hydrocarbon oils are decomposed with the formation of products of low-boiling point by treatment with an alkali metal, such as sodium or an alloy of same, for example, a sodium lead alloy. The alloy is introduced either in a still with the oil or by passing the vapors through the molten metal. This is quite similar to the process of Deichler and Lesser (loc. cit.). It would seem that the oil must be perfectly dry, and air excluded for a safe and proper operation of this process.

Newmann[113] makes use of a semi-colloidal method of refining by treating the oil with a coal tar dye dissolved or suspended in water or with an aqueous solution of an aromatic base, preferably a polyamine compound.

Martini[114] makes use of a novel feature in refining by ionizing a current of air, steam or oxygen while passing an alternating current of high tension between a number of electrodes. The ionized gas or vapors are said to impinge at right angles against a jet of atomized crude petroleum, and at the same time the whole is subjected to the action of a magnetic field. They are then passed through a heater or still and are once more subjected to the action of a high tension electric discharge. It is claimed that the ions of the crude petroleum rearrange themselves according to the different specific gravities.

Charitschkow[115] states that chemical changes occurring in the purification of petroleum distillates by oxidizing agents have not been clearly explained. He postulates that the change of color is due to oxidation, and to the presence of sulphur esters. The latter are decomposed in secondary reactions forming dark resinous bodies which dissolve in the hydrocarbon compounds of sulphur. The odor he states may be partly due to unsaturated compounds or to nitrogenous bodies.

Henry[116] has shown that the discoloration of petroleum may be caused either by lighter or heavier hydrocarbons. In the first case he bleaches the oil by means of ozone. If the ozone is applied to the heavy oils, or those discolored by oxidation in the light, they become more deeply colored. Under these circumstances he treats the petroleum with a reducing agent, such as zinc dust, sodium hyposulphite, or stannous chloride, which act, however less perfectly than ozone in the previous case. Henry states that filtering through animal charcoal effects good results, and the process is rendered less expensive by washing the filter with a little acetone, which dissolves the coloring matter retained in the filter and can be easily purified by distillation.

The present author's experience with the use of ozone indicates that darker colored products are obtained when cracked distillates are distilled in the presence of ozonized air than alone.

Some work has been done to deodorized oils by adding to them substances which mask the odor or else which form compounds with the components of the oil so as to give a resulting compound possessing a pleasant odor. For example, Tempere[117] adds amyl acetate to petroleum in a proportion depending on the quality of the latter. An average of the amount added would be about 10 grams of amyl acetate to one liter of petroleum. The product possesses an agreeable odor and burns well.

Lenders[118] has deodorized oils by treating the mixture with essential oils such as turpentine, pine needles, various phenols and like substances. The mixture is then treated with alkali, and it is claimed that a condensation product of some of the odoriferous compounds in the naphtha is formed with the terpenes.

Methods of Desulphurizing Hydrocarbon Oils

In the refining of petroleum products the methods of desulphurization can be divided broadly into two classes (a) that which aims at complete desulphurization, (b) that which has to do prin-

(Continued on page 16.)

[89] de Fazi—Brit. Pat. 25,496 (1911).
[90] Rutgerswerke—Ger. Pat. 258,608 (1912).
[91] Chemische Fabrik Westend.—Brit. Pat. 6,825 (1912).
[92] Hamilton—Brit. Pat. 9,463 (1912).
[93] Melimid—Brit. Pat. 9,856 (1912).
[94] Grotzinger and Melimid—Fr. Pat. 443,650 (1912).
[95] Guillard—Fr. Pat. 452,167 (1912).
[96] Hense—Brit. Pat. 6,643 (1913).
[97] Myers—Brit. Pat. 19,391 (1913).
[98] Soc. Le Terebinto—Fr. Pat. 471,253 (1913).
[99] Schering—Ger. Pat. 278,486 (1913).
[100] Herber—U. S. Pat. 1,111,580 (1914).
[101] Dehnst—U. S. Pat. 1,112,602 (1913).
[102] Wohle—U. S. Pat. 1,081,801 (1914).
[103] All. Ges. Chem. Ind.—Brit. Pat. 3,572 (1914).
[104] Allgem. Ges. f. Chem. Ind. Holl. 2,093 (1917).
[105] Barnickel—U. S. Pat. 1,093,098 (1914).
[106] Skidmore and Conerty—Brit. Pat. 14,781 (1915).
[107] Dunstan—Brit. Pat. 119,751 (1917).
[108] Nelson—Brit. Pat. 113,131 (1917).
[109] Ruff—U. S. Pat. 1,263,289 (1918).
[110] Grisard—Brit. Pat. 136,169 (1919).
[111] Torossian—Jr. Ind. Eng. Chem. 13,903-4 (1921).
[112] Knibbs—Brit. Pat. 154,464 (1919).
[113] Newmann—Fr. Pat. 428,471 (1911).
[114] Martini—Brit. Pat. 16,432 (1907).
[115] Charitschkow—Chem. Tech. Rep. 30,476 (1906).
[116] Henry—Rev. de Chem. Ind. 10 (116) (1919).
[117] Tempere—Brit. Pat. 10,772 (1894).
[118] Lenders—Brit. Pat. 28,516 (1902).

Handling Hot Oils a Real Refiner Problem

Valves have long offered the greatest difficulty—What research has accomplished

*By E. E. Matheson**

IN MODERN petroleum refinery practice, as in other industries, the auxiliary equipment required for use in conjunction with main apparatus is being developed along specialized lines to meet the individual requirements of various classes of service. A case in point is the handling of hot oils, tars and residuum in distilling processes. The increasing temperatures and pressures involved are emphasizing the severity of this problem, particularly with regard to the conditions imposed upon the valves used to control these fluids. Refinery engineers are finding that valves designed for other types of work are far from satisfactory for handling hot oils, even though the construction and materials be of the best. In consequence, numerous modifications of existing designs and a number of special new designs, as well, have appeared, and in a great many plants tests of one sort or another are under way, in the search for better equipment.

It has been the privilege of the writer to assist in the investigation of the causes of failure of conventional valve types on hot oil lines and in the development of improved apparatus for that service. In establishing specifications for such valves, several angles must be considered, including those of tightness, ease of operation, safety and economy, in terms of ultimate service.

Gate Valves

Gate valves, of the outside screw and yoke, solid wedge type, have been widely used on stills, heat exchangers and other distilling apparatus, but, serviceable as such valves may be under less extreme conditions, they are subject to failure from a number of causes when used on oils at 500 degrees Fahrenheit and up. In a gate valve, closing is accomplished by pressing together two accurately fitted seating surfaces. It is obvious that a solid deposit on or between these surfaces will either keep them apart, or be pressed into the material upon which they are formed, in either case impairing the efficiency of the valve. Such deposits are invariably found on the interior surfaces of vessels and piping employed in the distillation of petroleum, due to sand and sediment, and to the formation of coke, or granular carbon. Seat and face rings are also rapidly attacked by sulphur and other corrosive agents always present to some extent in unrefined petroleum oils, this action being aggravated by the high temperatures employed. In extreme cases this corrosive action has resulted in loosening the seat-rings from the body, and even in eating away the stem until the wedge was allowed to drop free. In any event, pitting of the stem is rapid, this complicating the problem of keeping the stuffing-box tight against leakage. If the packing is drawn down tightly around the smooth upper portion of the stem, when the valve is in the closed position, subsequent opening may draw a badly pitted section of the stem into the packing space and permit excessive leakage. If the packing is then tightened to stop the leak, closing will be found very difficult, and will probably result in tearing the packing badly. The use of an inside screw will avoid this difficulty, but will result in even more pronounced and rapid failure, due to the obvious exposure of the thread to corrosion. Another common source of trouble with gate valves is the prevention of tight closing by solid deposits at the bottom of the body, between the seat-rings—a natural trap for sediment when the valve is installed in a horizontal line. All of the above difficulties combine against the gate valve, and, in many cases, result in speedily reducing the valve to an inoperative condition, with corresponding inconvenience and expense to the refiner.

Valves for handling hot oils around refineries have long afforded a problem for the refiner. The accompanying article discusses this problem from an engineering standpoint. Many of the conclusions drawn are most interesting, and doubtless there will be some who will differ with Mr. Matheson. The Refiner and Natural Gasoline Manufacturer is glad to offer its columns at all times for the discussion of subjects that have a real interest to the refining and natural gasoline industry.—Editor.

Designers of refinery piping, in search of relief from such trouble, have frequently turned to the best grade of cast steel valves, of the type successfully used for high-pressure superheated steam. This sort of equipment, although constructed to high standards, lasts but little longer than less expensive types, although resistance to corrosion is increased by the monel metal or nickel trimmings employed. Still valves, particularly in the case of continuous or circulating systems, ordinarily remain open during operation, a fact which works against those types in which the seating surfaces separate in opening.

Research Results

The search for a valve to overcome all known drawbacks has revealed unexpected possibilities in an entirely different type, namely, the stop cock. The stop cock, or plug valve has certain inherent advantages of particular benefit in handling hot oils, the most important of which is the fact that in operating the seating surface do not separate, but merely slide one upon the other, affording mutual protection against the destructive agencies of the fluid stream. Furthermore, ruggedness, compactness and simplicity are easily incorporated in the ground-plug design of valve, and operation is quick and positive.

The stop cock, reduced to its elementary form, consists of a body provided with siutable piping connections and a fluid way, interposed in which is a tapered plug fitted to a ground seat, the plug being provided with a port or passage which can be made to register with the body passages upoon rotation. For any but the simplest requirements, some additional means must be provided for holding the plug in place. In modifying the stop cock so that it will serve modern industrial requirements there are two things which the designer must keep in mind. The first is that the plug must be kept seated at all times to insure effective operation and to escape damage, and the second is that the plug has a natural tendency to stick under certain conditions.

Great Variety

A survey of existing types disclosed a great variety of mechanical devices for retaining the plug, providing more or less effective operation. Service tests of a great many stop cocks revealed two serious drawbacks which made the valves tested undesirable for hot-oil and similar severe conditions, these being inadequate provision against sticking or for relief of sticking, and, in some cases, complication of parts. A familiar form is that in which a nut is applied to the lower end of the plug, the nut having under it a washer bearing against the body. Tightening the nut draws the plug into place, but, in case of sticking, which is extremely likely with this crude adjustment, the only recourse is to hammer the lower end of the plug, which procedure damages the thread and soon puts the cock out of commission. Another common arrangement consists in disposing a stuffing box and gland at the upper part of the body so that the packing holds the plug in place, the body being closed over the lower end of the plug. Here no means whatever are provided for loosening the plug, should it become stuck. In a rather ineffective effort to remedy this condition, a lift screw with a jam nut is sometimes put through the bottom of the body. The small thread of the screw is hardly equal to the task, and is easily damaged by wear or corrosion. Then there is the possibility that, the plug being once raised, it may be prevented from seating again, either by an accumulation of solids, or because the screw is not turned back far enough.

There are numerous modifications of the closed body type of stop cock, embodying cam mechanisms, expanding plugs, etc., all providing means for seating the plug, but none for raising it. Some of these designs involve considerable complication, with correspondingly increased sources of failure.

There is still another type, which may be described as the inverted plug cock, in which the plug is operated from its smaller end, the pressure of a spring being applied to the large end. In this valve the plug can be jarred

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loose, and for some nominal conditions, such a device may be useful. However, the spring will not endure in the presence of high temperatures or of corrosive agents, and a blow on the stem while the valve is under pressure may release a disastrous spray of the fluid.

Makes Radical Change

As a result of investigations along the lines described above, conducted by a refinery engineer of considerable experience, there was finally developed a stop cock design radically different from those previously employed, the application of which has met with unusual success in general use, and on hot-oil service in particular. The basic principle of this valve consists in mounting the plug between two opposing stuffing boxes, a stem, or cylindrical projection being carried through each gland to the outside of the valve. The valve is operated from a square formed on the upper stem, and the lower stem is present as a provision for raising the plug in emergency by the application of external force. With the plug fitted to a good seat in the body, tightness and smooth operation can be simultaneously assured by the adjustment of the two glands. This method of adjustment allows for keeping the plug seated at all times without the use of delicate internal parts and without limiting the rotation of the plug to 90 degrees, as is the case with a number of well known makes. Rotation through a full circle is of advantage in more evenly distributing wear, and permits the valve to operate in either direction. The use of a ratchet wrench is a convenience in close quarters and with a full-turn cock it will generally be unnecessary to reverse the ratchet pawl in opening and closing any number of valves at a given installation.

The double packed construction has proven a surprisingly simple and effective method of avoiding the weaknesses common to stop cocks. The retention and adjustment of the plug is positive and at the same time allows exceptionally free action of the plug, by virtue of the cushioning and guiding effect of the packing. The provision for loosening the stem in the event of sticking under adverse circumstances is at once positive and without objectionable features. A smart blow on the lower steam is found to loosen the plug at once, without, however, causing it to remain off its seat, with consequent leakage and intrusion of grit, as the packing at the upper part of the valve absorbs the shock and returns the plug immediately to a good bearing on the body. The lower stem is not subject to damage from such treatment, as it may be of heavy section and beveled at its extremity, to avoid the formation of burrs.

The extreme measures last described are seldom required, however, although the fact that such a valve may be moved under conditions where any other type would be hopelessly frozen may prove invaluable on one of those infrequent but serious cases, where the failure of a valve to operate may result in considerable inconvenience or damage. Numerous tests have been made with stop cocks of the double packed construction to determine the possibility of hopelessly freezing the plug in the body. In these tests the interior of the valves was exposed to sol-ammoniac solution, salt water, various acids and sodium silicate solution and other solutions which deposit crystallized solids, with the conclusion that, aside from actual destruction of the valve by corrosion, it may be depended upon to operate while in position in the line in any conceivable situation.

Adapting Stop Cock

In adapting a stop cock of this construction to hot oil service consideration has been given to the severity of the conditions imposed. Because of the penetrating effect of very hot oils and vapors, a generous overlap is required at the top and bottom of the plug and between the body and plug ports when valve is in the closed position. The body is necessarily made of cast steel to withstand the severe stresses set up in heated piping. The use of a cast steel plug has been found unsatisfactory in some cases where the oils have little or no lubricating valve, such as on hot crude naphtha, etc., in intermediate processes, because of the natural tendency of the two closely fitted steel surfaces to seize. However, this difficulty has not manifested itself in many cases where hot, heavy tars and residuum are to be handled. For general hot oil conditions the use of a cast steel body and top gland with a "semi-steel" plug has been found more satisfactory, and entirely safe. The use of "semi-steel"—or cast iron to which a considerable percentage of scrap steel has been added in melting—is to be preferred over that of ordinary gray iron for the reason that this process materially reduces the percentage of graphitic, or uncombined carbon, with a consequent increase in tensile strength and impermeability. A lower percentage of silicon is also realized, which is of benefit because of the tendency of this element to aggravate the conversion of combined carbon to graphitic carbon under the influence of continued high temperature, such conversion producing distortion and failure of the casting. The steel-body, semi-steel-plug construction has been adopted as a standard for hot oil service in the Victory valve, this being the commercial name under which the double packed stop cock is produced.

It has been necessary to give considerable attention to the selection of proper packing material. The packing must withstand tempertures as high as 800 degrees Fahr., and even higher, and must be immune to the action of oils and vapors at these temperatures. Service tests extending over a number of years have shown the most satisfactory material to be a firmly braided asbestos packing, made up of a yarn of good quality, long fibre asbestos, with annealed copper wire insertion. The use of wire in the packing allows tighter braiding, and helps to keep the material together, frequently permitting a part of the packing to be replaced when repacking is required. Space for not less than three rings of packing has been found advisable, as well as the provision of extra-long followers on the glands, to allow for maximum adjustment, and for maximum useful life of the packing. The packing material should not be soaked in a lubricant, as any oil present will burn out, allowing the packing to become slack and leaving behind undesirable deposits of carbon. For purposes of lubrication, the packing is well graphited before insertion, and a little dry graphite added between rings. Metallic packings are unsuitable because of their lack of resiliency, although one ring of metallic foil packing has been successfully used at the bottom of the stuffing box, the remainder of the space being packed with the braided asbestos.

By-passing connections to coolers, condensers, heat-exchangers and similar apparatus may be very conveniently and compactly made with the use of three-way valves of the type described, with a considerable saving in the total number of valves and fittings required. Valves so installed should be considered as control valves for directing the flow, and should not be depended upon to act as shut-off valves if any great pressure is involved. For stills, either straight run or continuous, straight way valves only should be installed, because of their greater dependability as positive block-valves.

Require Special Valves

Cracking plants and other high-pressure distilling apparatus require special valve types on account of the extreme pressure and temperatures used. The stop-cock previously described will function satisfactorily on high pressure installations, but in the interest of safety, special means to retain the plug independently of the top gland should be provided. To this end a modified type was designed, embodying a bolted guard secured to the upper part of the body, this guard carrying the upper packing space and gland. Although not bearing on the plug in normal operation, the guard acts to restrain the plug from blowing out in the event of failure or removal of the gland.

A study of refinery operating conditions reveals the need of careful attention to piping control, especially on distilling apparatus. The multiplicity of valves required prohibits the individual attention given pumps and other auxiliary mechanical appliances. Valves are installed and left to themselves, and are required to respond to constant or intermittent operation with equal effectiveness. It is impossible to try every valve every day to assure that it is in good operating order, although any one of numerous valves may, after a long period of disuse, be called upon to protect life and property during emergency, whether it be to shut off positively against a broken line, or to open the pumping-out line to a still in case of fire or other accident. For this reason, the writer feels the effort given this study to be more than justified, and that the results to date are more than satisfying.

Cambridge, Kan.—The Empire Companies have started construction on their gas compressing station here, which will have an approximate daily capacity of 40,000,000 cubic feet. A site of about 20 acres is provided for the plant, the foundation work on which already has been completed and orders placed for all machinery and equipment.

Los Angeles, Calif.—A contract for 5,000,000 barrels of crude has been closed between the Nippon Oil Company of Tokyo, Japan, and the General Petroleum Company. The contract extends over a period of five years.

Mixing of Air With Gas in Lines Not Only Dangerous But Cuts Production

By V. Wichum, M. E.

THE MIXING of air with natural gas, mixes into gasoline production a grave element of danger and causes a considerable decrease in production.

The dangers and losses due to this contamination of gas with air are caused by (1) the formation of an explosive mixture in the lines; (2) inefficient production of gasoline because of improper cooling after compression, imperfect precipitation, increased volume of mixture to be handled, and decrease of effective pressure on gasoline vapor; (3) excessive wear on the equipment. A closer inspection of these effects brings out some interesting points.

The Tag-Mono Air Recorder

An explosive mixture is formed by the presence of air in the gas in certain ratios. Disastrous explosions have resulted when such mixtures become ignited within the line by a spark which may be caused by so slight a disturbance as the striking of a pebble against an obstruction in the pipe.

The thermal value is lowered and an element of danger introduced when gas containing air is consumed for light, heat or power. The admixture of air either produces explosions at the burner or, if the air is in a slug, extinguishes the flame or pilot light so that on the return of the gas to the burner there is danger of explosion or suffocation.

The production of gasoline is decreased because of the efficiency of the various operations is reduced by the presence of air in the gas.

Effective compression cannot be obtained because a lean gas (one containing considerable air) causes the compressor to run hotter than does a rich wet gas. The compression of a rich wet gas produces two-thirds the heating effect of a dry gas and about one-half the heating effect of air. The result is that when it becomes necessary to handle lean gas, the compressor runs hotter which means that more cooling is required or else the compressed gas is delivered at a higher temperature.

The efficiency of the cooling system is lowered by the delivery of this warmer gas. The precipitation is less perfect and the separation of the vapors is incomplete. The waste gas, which under these conditions is very rich gas mixed with air, is usually utilized in running the engine of the plant. Because it fires too soon and burns too rapidly, it causes undue heating of the engine cylinder, excessive wear and decreased power delivery.

Gasoline vapor is carried out in the waste gas, the air acting as a vehicle. Thus 1000 cubic feet of gas of a certain richness will produce three gallons of gasoline, but if mixed with 1000 cubic feet of air only two gallons can be obtained.

The output of all operations is smaller simply because the more air a given plant is forced to handle, the less gas it can handle and consequently the less gasoline it can yield.

In the producion of gasoline by compression, the effectiveness of the pressure on the gas is reduced by the presence of air. The pressure necessary to start condensation must be twice as great if the air present has increased 50 per cent. As it is not usually desirable to change the pressure, the introduction of air is responsible for a serious decrease in gasoline production.

Because of these dangerous and troublesome effects, the exclusion of air from pipe lines is essential to safe and economical operation.

But the detection of leaks in vacuum lines by ordinary methods is impossible. Periodical inspection of the lines by throwing them out of service and applying gas or air pressure is an expensive procedure. Occasional tests with a portable Orsat apparatus do not give the continuous information which is the only guide to the true conditions. The one method which seems to meet every requirement is provided by the Tag-Mono air recorder.

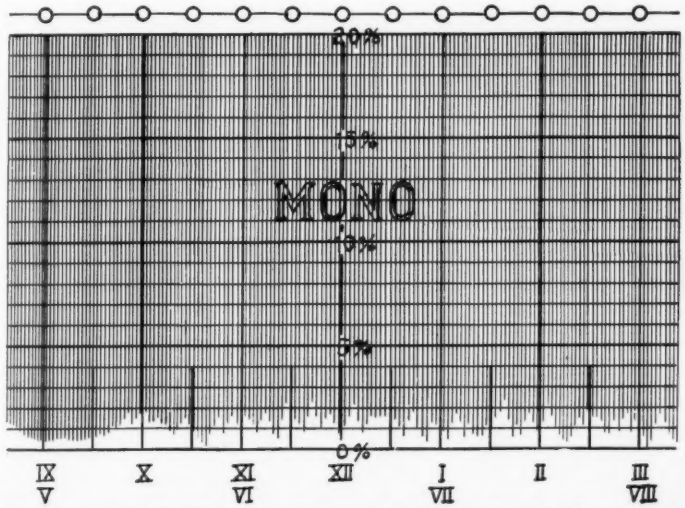
This dependable device shows the percentage of air in the gas at all times by writing a continuous record on a chart, a section of which is shown. By this record which is automatically made six to 10 times in every hour of the 24, every day in the year, the operating force knows exactly what percent of air they are handling with the gas.

As soon as the air percent becomes dangerously high or even high enough to lower efficient compression and absorption, immediate steps can be taken to locate and eliminate the leakage which is responsible.

The Tag-Mono air recorder is simple, extremely accurate and entirely automatic in operation. It has been installed in the Mid-Continent field where it is giving excellent service.

The illustration at the left shows the Tag-Mono air recorder, while at the right is shown a reproduction of a typical chart section. The distance between the end of each vertical line and the bottom line on the chart represents the air percentage. Each line represents a separate automatic analysis. During the first half hour the air content dropped from one and one-half per cent to one-half per cent, stayed at one-half per cent for the next hour, then went up to almost two per cent, etc. This record is before your men at all times. It is continuous, it is automatic, and it is accurate. It gets results.

Baltimore, Md. — Officials of the Standard Oil Company (New Jersey) have denied reports to the effect that it was in any way interested in gaining control of the Silica Gel process for removing discoloration from oils. Silica Gel process is controlled by the Davison Chemical Company.



A reproduction of a typical chart section. The distance between each vertical line and the bottom line of the chart represents the air percentage. Each line represents a separate automatic analysis

Will Fuel Oil Be Refiner's Panacea? Product Might Help Rectify Situation

By Marshall Monroe

IT IS a safe bet that the refiner has done more real constructive thinking during the past few months with the market going into convulsions periodically, than ever before. If he, collectively, has ever gotten down to brass tacks and considered, pro and con, the many ramifications of the industry as it affects him, it is now.

Dating back several years a controversy has gone on over a stable price for fuel oil. Men of the industry have gotten into convention on it; refiners and representatives of potential fuel oil consumers have met and thrashed the question over, but nothing definite has ben done.

With the memory of a real menace in the East in the form of an impending anthracite strike fresh, the present would seem to be a propitious time to ponder the matter further—to have a frank discussion of the question, up and down.

We may safely assume at the outset that so far as desirability is concerned, no question exists from the standpoint of the consumer or the potential consumer. A case at point is the experience of one railroad which recently made a test of the advantage of oil over coal. This road operates a train from St. Louis to Oklahoma City, a distance of approximately 540 miles. With coal burning equipment, three locomotives were required to move this train over that distance.

Burning oil, one locomotive handles the train nicely. One day of rest at the terminal and it is ready to make the return run. At once we have a great economy in the necessary extent of equipment. Then we have saved, as well, the turning cost at each division and the cost of frequently cleaning out the grates, fire box, flues, and so on.

Added to this economy the results from firing oil are so far ahead of the other fuel as to make that favorable point alone almost irresistable. Uniform heat, less rigorous wear on the flues and boilers and ease of operation can be listed there.

The average cost of converting a locomotive, according to experiences of the road mentioned, was $1500. It will cost $300 to re-convert it to a coal burner.

But—the railways themselves do not want to go back to coal, that is the roads now using oil, and numerous other roads will convert their equipment to oil burning, once a stable price and steady supply of fuel oil is assured.

Aside from the railway markets, real and potential, there are numerous large cities in the East to consider. Just a short time ago Kansas City had the distinction of being the largest fuel oil consumer in the country, utilizing this fuel for virtually all power purposes, heat and light. So rapidly has the growth of fuel oil use come, that Chicago now leads, with several other cities close behind. Boston, New York, Philadelphia, Cleveland, Cincinnati, and St. Louis are all good potential markets for fuel oil.

What can win these markets? Only an assured supply at a fair price.

There has been a queer twist in fuel oil prices during the last few years, and these must be removed before the objective of a heavy, steady and profitable demand for fuel oil will materialize. At present fuel oil is generally quoted at 60 per cent of the posted crude price. When crude oil price goes down, as it generally does in the winter months, the fuel oil price likewise follows it. Just at that time the fuel oil demand, particularly from the cities, is the heaviest.

On the surface, this is an improper state of affairs—diametrically opposed to the law of supply and demand.

Getting closer home, several large railways, already burning oil entirely or partially, are viewing with downright concern the prospects of a fuel oil shortage. From what has gone before it is plainly evident why they wish to continue burning oil and at the same time what grounds they base their fears upon. Several refiners have already commenced cracking their fuel oil, and added to this a number of fuel oil contracts are about to expire.

Panacea Hard to Find

The writer who sets out to offer a universal panacea for any trouble, regardless of what industry it affects, is extremely foolish. He can, at best, simply offer the different phases—set down the results of his surveys—leaving decision to the reader.

So in the case of fuel oil a "cure all" is elusive.

A flexible method of operation which would enable the refiner to turn out sufficient fuel oil to meet the demand, and kerosene in proper proportion, manufacturing only such gasoline as the market demands, should go a long way toward rectifying the present situation, and should effectively lessen the prospects for a recurrence of the current debacle.

There is no question but that with the great additional fuel oil market created through assurance of a steady supply at fair prices, the demand would be considerably increased. For every barrel of fuel oil turned out there should be, likewise, a decrease in the amount of gasoline produced.

As gasoline is heaviest in demand during the summer, spring and early fall months, fuel oil would be less plentiful during that time. With the falling off in demand for gasoline as the open weather departs there will be a quickening in demand for fuel oil as rigorous weather comes nearer and is at hand.

Though a few cents might be lost at odd times of the year through a comparatively stable price, governed more strictly by the law of supply and demand, there would be the added advantage to the refiner of a much longer market, a demand not equalled at present, for his fuel oil.

A recurrence of the episode of 1917 when fuel oil reached $4 a barrel will be likely to retard the spread of use of this fuel to an extent requiring many years to overcome.

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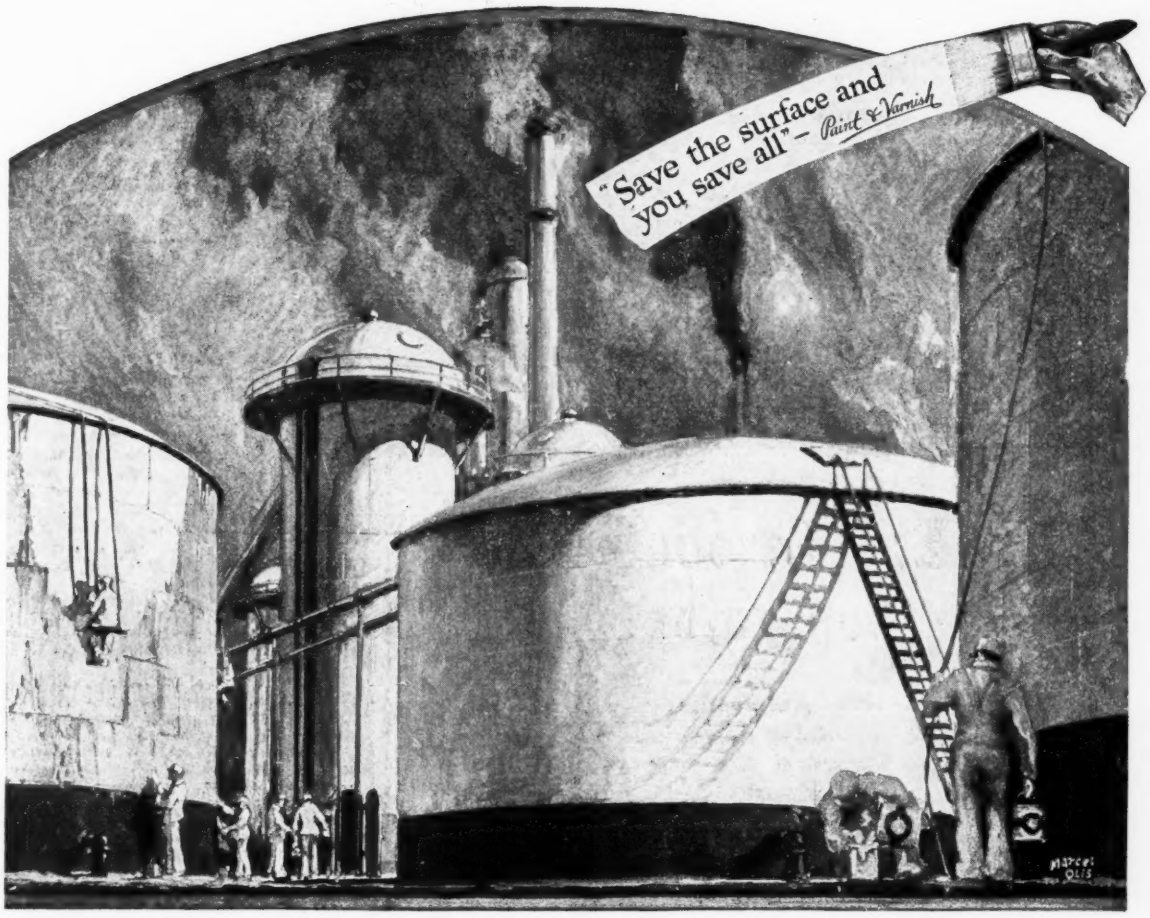

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The Various Methods Of Petroleum Refining

(Continued from page 10.)

cipally with the removal of certain types of sulphur compounds and elementary sulphur as to allow the oil so treated to pass certain specification tests, such as, the doctor test and the corrosion test. The latter result is the chief aim in most cases of refiners. It is to be particularly noted here that an oil may pass such specification tests and still contain a relatively high per cent of combined sulphur.

In general the three classes of sulphur compounds present in oils are free sulphur, hydrogen sulphide and organic sulphur compounds. The first two classes are those whose presence will give a positive corrosion test. The presence of hydrogen sulphide as well as of certain types of the latter class will give a positive doctor test. The presence of the first two classes of compounds will also affect the metallic parts of the motor sometimes causing serious damage if the percentage is high. No quantitative measurements have as yet been made on the effect upon the motor parts of the organic sulphur compounds. The presence of a high percentage of these organic sulphur compounds will tend to throw the gasoline off color if the latter is not properly refined. On the other hand cracked hydrocarbon oils may contain a considerable amount of organic sulphur compounds and still remain water white in color and sweet in odor.

Thio-phenes, thio-phanes, sulphonic acids, alkyl sulphates, alkyl sulphides or thio-ethers and mercaptan or alkyl hydro-sulphides have all been isolated from crude petroleum or its distillates (see reference Egloff and Morrell[119]). For a summary of the compounds of sulphur in petroleum oils see Engler Hofer[120] and also Technologic Paper No. 177[121].

Below are indicated some of the various methods for desulphurizing oils. These methods aim particularly at the removal of sulphur, although they may fall in any of the classes previously cited, and further may be no more efficient for the purpose mentioned than some of the others already mentioned.

Fordred[122] refines oil derived from coal and solid hydrocarbons by treating with caustic soda and sulphuric acid. The oil is then treated with Fuller's earth.

Parsons[123] passes the hydrocarbon vapors through a moss composed of a mixture of charcoal and oxides of iron or calcium. He recommends further the distillation of the oil with super heated steam.

Schmidt[124] proposes the use of sodium hyposulphite in acid solution. He claims a saving of sulphuric acid and a good deodorizing action. Sodium sulphite or hyposulphite is as a rule used, although the sulphites or hyposulphites of any metal which will not discolorize the oil can be made use of.

J. A. Dubbs[125] desulphurizes oils by blowing through them a stream of gas rich in hydrogen. The sulphur is removed in the form of hydrogen sulphide. See also the Dubbs[126] patent 1899, in which the oil is treated with arsenic or its salts in order to free it from sulphur.

Frasch[127] distills the oil containing sulphur in the presence of oxide of lead or copper oxide or a mixture of the two. The lead oxide serves to remove the sulphur compounds from the lighter portions of the oil but becomes inactive at higher temperatures. The copper oxide on the other hand will remove the sulphur compounds at the higher temperatures more efficiently than at the lower temperatures. A mixture is, therefore, the best. Some inert material is mixed with the oxides in order to give increased surface. Iron oxide is also sometimes added to the mixture of the preceding oxides.

McGowan[128] removes sulphur compounds from petroleum products during the process of distillation by blowing air through the oil, the air is superheated before introducing into the bottom of the still through perforated pipes. The oxidation products of the sulphur are sulphur dioxide and sulphur trioxide. In order to avoid the formation of a red coloration in the distillate a strong alkaline solution is introduced into the still in order to form corresponding salts. Ammonia, ammonium hydroxide or solid caustic soda may be used for such purposes.

Kennedy[129] treats the oil with copper sulphate, caustic soda and common salt. One pound each for two gallons of water will treat 40 gallons of oil. The mixture is kept at the boiling point for one hour and it is claimed that the treatment frees the oil of sulphur.

Johnson[130] allows the crude petroleum distillate to flow slowly between or remain in contact with plates or sheets of lead and carbon placed in close proximity, but not touching each other. The nature of the reaction has never been definitely ascertained. The oil turns dark red and somewhat opaque and when subsequently refined by an ordinary acid treatment deposits a whitish powder. The lead appears to be the active agent although it is not corroded. It has been found that discharging the oil in a vessel containing water before the acid treatment removes some of the impurities.

Kayser[131] treats the oil in the vapor state with carbon monoxide at around 390° F. and a series of tubes between the still and the con-

[119] Egloff and Morrell—Chem. & Met.
[120] Engler Hofer—I, 463-479.
[121] Technologic Paper No. 177—Bureau of Standards—"Sulphur in Petroleum Oils."
[122] Fordred—U. S. Pat. 54,276 (1866).
[123] Parsons—U. S. Pat. 88,978 (1869).
[124] Schmidt—U. S. Pat. 164,494 (1875).
[125] Dubbs, J. A.—U. S. Pat. 470,911 (1892).
[126] Dubbs, J. A.—U. S. Pat. 407,182 (1889).
[127] Frasch, H.—U. S. Pat. 500,252 (1888).
[128] McGowan—U. S. Pat. 257,961 (1882).
[129] Kennedy—Brit. Pat. 6,018 (1887).
[130] Johnson—Brit. Pat. 8,348 (1896).
[131] Kayser—U. S. Pat. 640,918 (1900).

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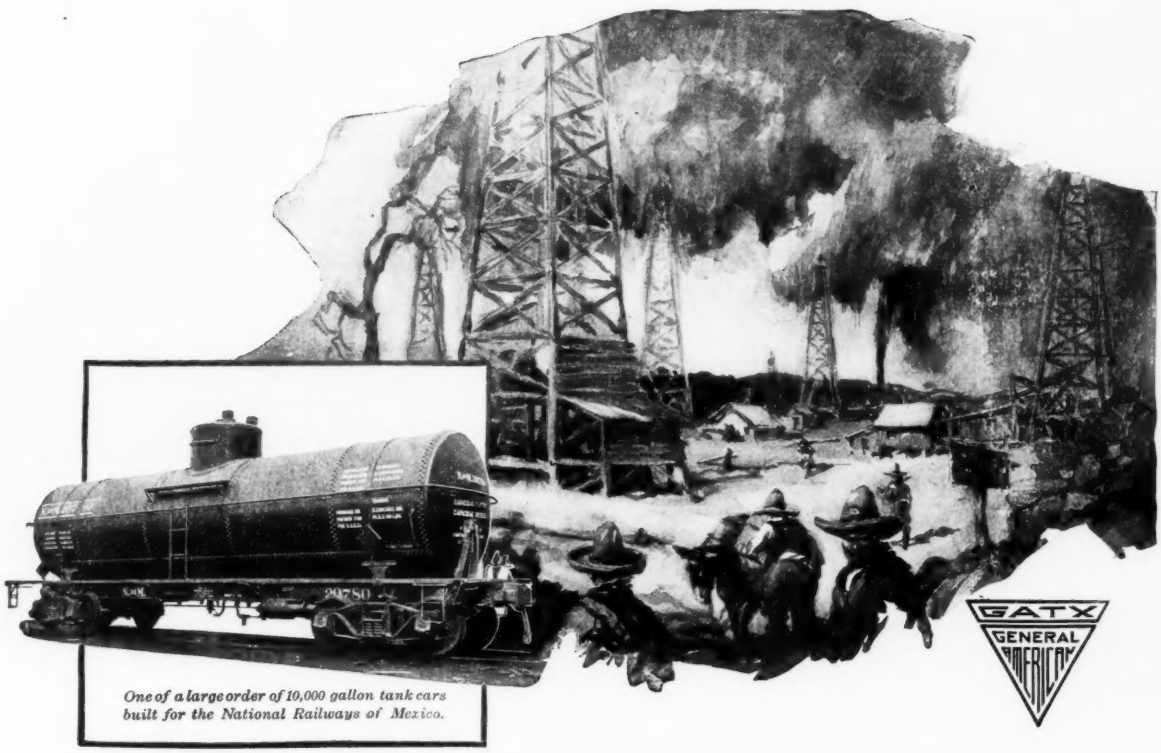

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denser. A subsequent sulphuric acid treatment is given.

Henry[132] uses potassium plumbite after treating with sulphuric acid, and also gets good results by using a successive treatment of potassium hydroxide and lead acetate.

Smith[133] heats the oil with spirits of turpentine in the proportion of one gallon of the latter to 500 gallons of oil. For heavy distillates, rosin is substituted for the turpentine, using about three pounds to 11,000 gallons of oil. The mixture is heated to a temperature just above the initial boiling point. This treatment is followed by a sulphuric acid treatment with the usual neutralization with caustic soda.

Amend[134] after treating the oil with acid agitates it with a solution of an alkali containing an excess of a solution of copper salts. The oil is then removed with sulphuric acid and finally with water.

Adiassewich[135] desulphurizes the oils by heating under pressure successively with dilute sulphuric acid, caustic soda and finally with aluminum chloride. The latter is preferably washed out later.

Robinson[136] finds that a heavy treat on light distillates using as high as 60 pounds of sulphuric acid per barrel will give very satisfactory products.

Walker[137] effects desulphurization by passing the vapors of petroleum distillate over anhydrous copper chloride and then into an alkaline solution of a lead salt.

Robinson[138] and Eggleston[139] heat sulphur bearing petroleum or petroleum distillates progressively to a temperature ranging between 300 and 500° F. The purpose of this preliminary heat treatment is to drive off the hydrogen sulphide. The hydrocarbon vapors are condensed and the hydrogen sulphide is oxodized into sulphur dioxide and neutralized for the manufacture of sulphuric acid.

Hall[140] charges oils such as shale oil with sulphur dioxide. The oil is then distilled and suspended sulphur formed at this state may be separated by filtration. Any remaining sulphur is removed by other methods, for example the Frasch.

Bergius[141] mixes the hydrocarbon oils with metal oxides and the mixture is then heated under pressure to about 200° C. The pressure is externally produced preferably by means of hydrogen.

Evans[142] removes sulphur from an oil by heating the latter in the liquid or vapor phase with hydrogen, or with a gas containing free hydrogen in the presence of a catalytic agent such as nickel, iron cobalt and copper. Pumice, fire clay, and asbestos are used as carriers of the catalyst.

Hood[143] makes use of ignited magnesite to dissociate the sulphur compounds. These compounds in a vaporized state are then passed over an absorbent, for example iron oxide.

Cobb[144] makes use of hydrogen sulphide dissolved in sodium hydroxide solution, resulting in the production of an alkaline sulphide. In the treatment of hydrocarbon oils containing free sulphur the former is heated at 70 to 90°. The free sulphur is supposed to be reacted upon.

Sherman[145] heats the oil in the still and the vapors are passed through a deep layer of inert granular material. The latter is supposed, owing to its resistance to the passage of the vapors, to increase the boiling point of the oil sufficient to eliminate grease and sulphur and cause the carbon to deposit.

Ellis[146] passes oil vapors through pipes or retorts heated from 400 to 600° together with 20 to 50 per cent of water vapor. The mixture of vapors is passed over copper plated or nickel plated jackstones. He claims desulphurization as well as hydrogenation.

Lucas, Palmer and Perkins[147] remove sulphur or other undesirable substances from mineral oil by subjecting the latter while heated to the action of ammonia. The ammonia, it is claimed, reacts with the sulphur converting it into easily removable compounds by subsequent treatment. The oil under certain conditions of treatment is forced at high velocity and pressure through tubes in which it is heated to above the normal boiling point and then allowed to expand suddenly. Before such treatment the oil is saturated with ammonia.

Mantle[148] heats heavy oils containing sulphur with copper oxides having previously allowed water and heavy impurities to settle out. He uses about one ounce of copper oxide to a gallon of the oil and finally filters through asbestos.

Cobb[149] removes elementary sulphur from petroleum oil by heating the latter with a solution of an alkaline sulphide maintaining the temperature at 70 to 90°, separating the sulphide from the oil and then treating the rest with water and steam to remove the residual sulphide.

Evans[150] removes sulphur from naphtha by mixing the vapors of the latter with hydrogen then passing the mixture over a catalyst such as nickel and fire clay. The latter is heated to around 450° F. The vapor is condensed and the hydrogen sulphide removed from the condensate.

Hood[151] vaporizes the oils and then brings the vapors into contact with heated alumina, bauxite or magnesite. He claims that the sulphur compounds present are dissociated with the formation of hydrogen sulphide. The latter is

[132] Henry—Brit. Pat. 1,664 (1898).
[133] Smith—Brit. Pat. 30,662 (1897).
[134] Amend—U. S. Pat. 747,347 (1903).
[135] Adiassewich—Brit. Pat. 4,431 (1903).
[136] Robinson—U. S. Pat. 910,584 (1909).
[137] Walker—U. S. Pat. 955,372 (1910).
[138] Robinson—U. S. Pat. 1,018,374 (1912).
[139] Eggleston—U. S. Pat. 1,018,040 (1912).
[140] Hall—Brit. Pat. 26,756 (1913).
[141] Bergius—Ger. Pat. 290,563 (1913).
[142] Evans—Brit. Pat. 22,147 (1914).
[143] Hood—U. S. Pat. 1,404,293 (1922).
[144] Cobb—U. S. Pat. 1,413,005 (1922).
[145] Sherman—U. S. Pat. 968,088 (1910).
[146] Ellis—U. S. Pat. 1,396,999 (1921).
[147] Lucas, Palmer and Perkin—Brit. Pat. 108,019 (1916).
[148] Mantle—Brit. Pat. 126,882 (1918.)
[149] Cobb—U. S. Pat. 1,300,816 (1919).
[150] Evans—U. S. Pat. 1,257,829 (1918).
[151] Hood—Brit. Pat. 145,818 (1919).

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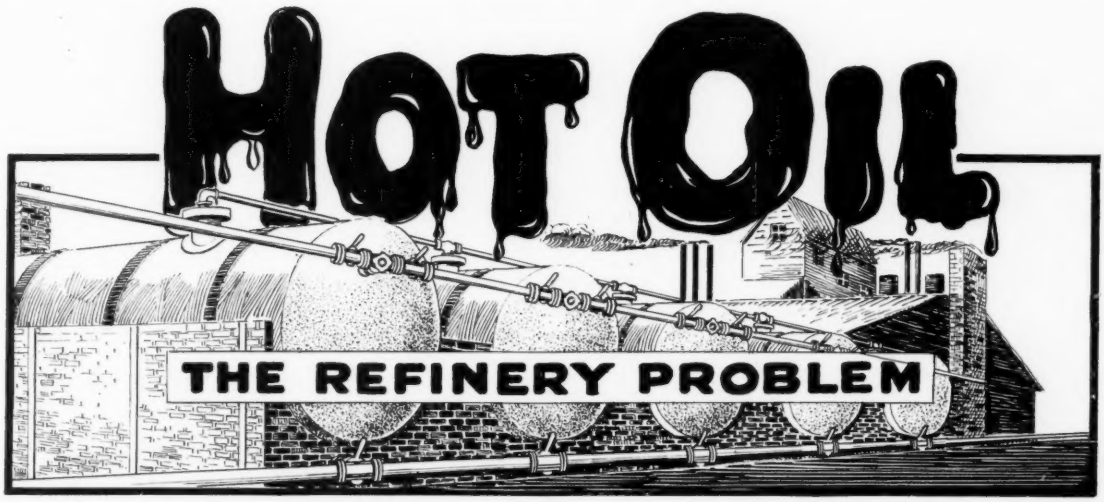

is put under absolute control when tar lines, crude stills connections, piping carrying residues and cracking plant recharging lines are equipped with—

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Double Packed Stop Cock Valves

"The Refinery Valves"

Victory Double Packed straightway and three way valves make a compact and reliable installation on both hot and cold sides of HEAT EXCHANGERS—COOLERS—CONDENSERS—ETC.

Use cast steel for temperatures. Semi-steel for cold and warm oils. Semi-steel valves with hard bronze plugs for cooling manifolds.

Let us tell you of the problems that Victory valves are solving in refineries. One little hint may save you thousands of dollars.

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INTERNATIONAL PETROLEUM EXPOSITION AND CONGRESS TULSA, OKLA. OCT. 8-14

Victory Mfg. Co.
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subsequently absorbed in iron oxide or other absorbing agents.

Forwood and Taplay[152] agitate the oil with alkaline solutions of alkaline earth sulphides at temperatures up to 40° C.

Benson[153] agitates the hydrocarbons under a pressure of 100 pounds per square inch with calcium oxide. The temperature of the mixture is raised to 250° F. The mixture is then pumped into a compression chamber where it is sufficiently reheated to volatilize the oil which passes into an expansion chamber. The vapors are further subjected to purification by treatment with quick lime in the expansion chamber from whence they are led to a fractionation tower.

Clancy[154] treats the heated mass of oil with ammonia and steam at a temperature sufficiently high to promote reaction without decomposing the ammonia. In a later process a mass of oil is treated with anhydrous liquid ammonia under pressure and in the presence of a catalyst. Further, he uses a catalyst in the presence of ammonia as well as ammonia per-sulphate.

A method of desulphurization which has been arousing considerable interest of late is that which makes use of various hypochlorites.

Most of the so-called hypochlorites used in connection with this method of refining are made by dissolving chlorine either in calcium hydroxide or in sodium hydroxide, preferably using an excess of the alkaline materials. When chlorine dissolves in water we have molecular chlorine in equilibrium with hypochlorous acid and hypochloric acid. Correspondingly when chlorine dissolves in calcium hydroxide or sodium hydroxide the salts of these acids are formed or a complex or mixed salt such as bleaching powder, i. e., the mixed hypochlorite and chlorine of calcium are formed.

The literature gives numerous examples of the use of chlorine or its compounds as desulphurizing agents in the refining of oils.

A. Brin and L. O. Brin[155] treat oil with oxygen, ozone or chlorine gases in order to decolorize and desulphurize them.

H. A. Frasch[156] treats oils with a suspension of chloride of lime or bleaching powder in order to refine them. This treatment is followed by one with sulphuric acid and then finally with a treatment of sodium plumbite. The latter reagent, it is claimed, is used only to remove chlorine compounds.

Gray[157] agitates the oil with a solution of chlorinated potassium hydroxide or sodium hydroxide. The latter is prepared by adding caustic alkali to a suspension of chloride of lime.

Armstrong[158] refines petroleum distillate by shaking with a reagent prepared by treating chloride of lime with water, separating the clear solution and then adding to it an alkaline carbonate.

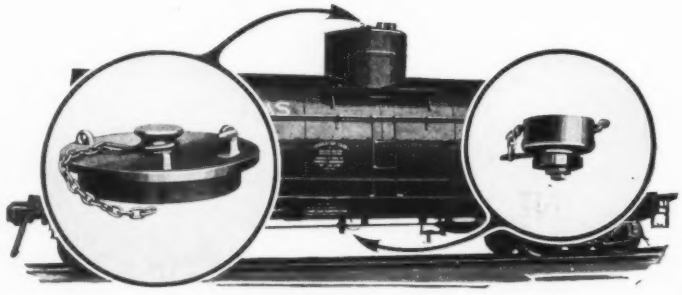
H. Frasch[159] treated oils with substances containing free chlorine and then removed any remaining chlorbodies by final treatment with a basic metal salt.

Colin and Amend[160] desulphurize petroleum distillates by means of a hypochlorite in alkaline solution. The reaction which they claim is principally one of oxidation is carried on in the presence of an oxygen carrier. The excess chlorine is removed by the use of some salt of a heavy metal which is capable of existing in two or more states of oxidation such as manganous and ferrous salt. They based their principle of oxidation upon the fact that when chlorine gas is passed into a solution of sodium hydroxide containing a so-called oxygen carrier such as manganese, cobolt, nickel, copper or iron, the hypochlorite is decomposed into the corresponding chloride and oxygen without the production of free chlorine, thus avoiding chlorination. The method of procedure is agitation of the distillate with a solution of sodium or calcium hypochlorite to which has been added a very small amount of maganous nitrate, manganese dioxide or possibly the hydroxide is thus formed and according to the theory of reaction gives up its oxygen to the sulphur compounds of the hydrocarbons and is then again reoxidized by the hypochlorite. The oxidizing power of the manganese dioxide thus formed is claimed to be very much increased by virtue of its fine state of division. The excess of hypochlorous acid or its salts is removed by some reducing agent as mentioned previously. Very good results are claimed by the application of this method.

Dunstan[161] makes use of an alkaline solution of a hypochlorite in the refining of oils and claims oxidation of the sulphur compounds with subse-

(Continued on page 36.)

[152] Forwood and Taplay—Brit. Pat. 129,349 (1917).
[153] Benson—Brit. Pat. 170,093 (1920).
[154] Clancy—Can. Pat. 215,387 (1922).
[155] A. and L. O. Brin—Brit. Pat. 10,968 (1886).
[156] Frasch, Hans A.—U. S. Pat. 525,811 (1894).
[157] Gray—Brit. Pat. 5,132 (1889).
[158] Armstrong—U. S. Pat. 837,655 (1906).
[159] Frasch, H.—U. S. Pat. 622,799 (1899).
[160] Colin and Amend—U. S. Pat. 723,368 (1903).
[161] Dunstan—U. S. Pat. 1,435,824 (1922.)



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If your stocks are low, a wire, letter, or phone message to us will give you immediate shipment on your order, at the best prices and discounts.

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Oil Well Rig Irons and Refinery Equipment

Western Iron & Foundry Co.

Wichita, Kansas

They used to ventilate with coils, too

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And for these reasons:

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—more rapid condensation.

—cheaper to install.

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—longer life—resisting corrosion both inside and out.

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Here is a typical installation below; condensing box of the Texhoma Oil and Refining Company, Wichita Falls, Texas.

The full story of Sterling Sections is contained in a brief eight-page illustrated booklet. Send for a copy at the address below.

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Condensing Sections are manufactured at our factories in

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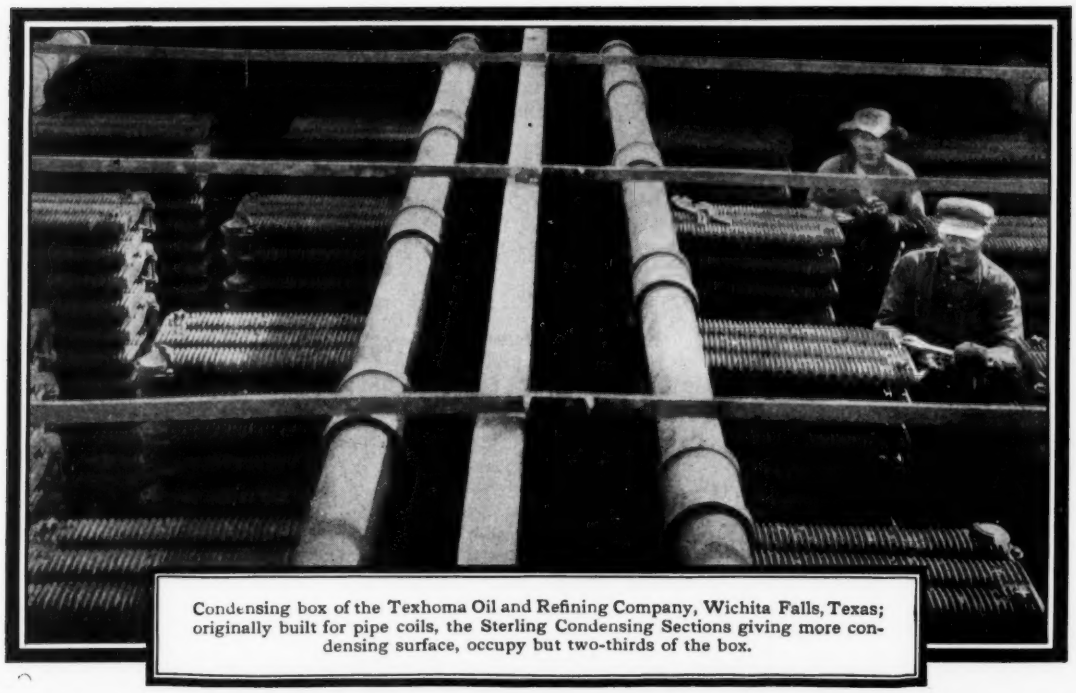

Condensing box of the Texhoma Oil and Refining Company, Wichita Falls, Texas; originally built for pipe coils, the Sterling Condensing Sections giving more condensing surface, occupy but two-thirds of the box.

Tell them where you saw the ad

PERSONNEL OF THE INDUSTRY

E. R. LEDERER

Vice President and in charge of refineries for the Invincible Oil Corporation and the Louisiana Oil Refining Corporation at Shreveport, La. Dr. Lederer is one of the most widely known refinery men in the country

Howard Bennette, recently elected secretary of the Western Petroleum Refiners Association, is making plans to move to Tulsa from Dallas about October 1, at which time the executive offices of the association will be removed to Tulsa from Kansas City.

E. R. Perry, vice president and general manager of Cosden and Company, and D. W. Moffitt, vice president of the same organization, who have been in Colorado, have returned to their offices in Tulsa.

Miss Elizabeth Miller of Tulsa, Oklahoma, assistant secretary of the Association of Natural Gasoline Manufacturers, is visiting at her home in Springfield, Illinois.

J. S. Cosden, president of Cosden and Company, was away from his New York offices the first of the month on a business trip to Tulsa and the Mid-Continent refining field.

A. C. Holmes, traffic manager of the Empire Refineries at Tulsa, Oklahoma, who has been at Braintree, Massachusetts, in connection with the arranging of traffic details for the new Cities Service refinery there was taken ill while on the job and was forced to undergo an operation at Winthrop, Massachusetts. He now is recuperating.

J. B. Simler, sales service engineer for the Bruce-MacBeth Engine Company of Cleveland, Ohio, is in Tulsa, Oklahoma, in connection with the establishment of a Mid-Continent branch.

V. R. Currie, general supervisor of the employment and service division of the refining department, and chairman of the refining department's central safety committee for The Texas Company at Houston, has left for Casper, Wyoming. From Casper, Mr. Currie will go to Buffalo, New York, where he will attend the congress of the National Safety Council, which is to be held during the early part of October. He will be met by five members of his committee in Buffalo, and will attend the congress with them.

F. G. Gissler of Dallas, Texas, district manager for the Conley Tank Car Company of Pittsburgh, Pennsylvania, has completed a tour of the Oklahoma refining field.

H. E. Johnson, vice president of Producers and Refiners Corporation, has left his Chicago office for a tour of the company's properties in the West.

F. J. Ryan, vice president and treasurer of the Sapulpa Refining Company of Tulsa, Oklahoma, has resigned his position as of September 1 and intends to go to the West Coast for an extended stay.

Our friend Vic H. Smith, general manager of the Lion Oil and Refining Company, is seeing all the sights of Alaska and the upper West Coast. A card from him during the past month indicates that while in the Ranier National Park, Vic climbed every trail, and shinnied up every gulley in the park. From Paradise Valley he went to Alaska to escape the heat. We hope he burns up when he gets back—anybody that sends us a message like he did, when the temperature in Houston was about to cause a divorce between the thermometer and the mercury deserves something hotter than a Tom and Jerry.

W. M. Priddy, head of the American Refining Company of Wichita Falls, Texas, departed for California early in September for a vacation, and also to look over the oil fields on the West Coast.

W. C. Hill, petroleum economist of the U. S. Bureau of Mines, is on a tour of the Mid-Continent, Mountain States and California divisions with the view of requesting refining companies to aid in speeding up refinery statistics in this country. Mr. Hill will visit at Denver and possibly Casper, Wyoming, on this trip.

O. F. Kluenter, representative in the Mid-Continent for the Schaeffer and Budenberg Manufacturing Company and the American Steam Gauge and Valve Manufacturing Company, division of Brooklyn, New York, has opened an office at 702 South Cheyenne street in Tulsa, Oklahoma.

J. F. Lawrence, former general counsel for the Western Petroleum Refiners Association, has severed his connection with that organization and has opened law offices for himself in the New York Life building in Kansas City.

E. J. Freeman, former vice president of the Acme Petroleum Company, and at present associated with the C. A. Gustafson Company in Tulsa, Oklahoma, has opened an office at 1201 Atlas Life Building where he will represent several other marketing concerns in addition to the Gustafson Company.

Fayette B. Dow, well known lawyer and legal representative of the American Petroleum Institute, Western Petroleum Refiners Association, National Petroleum Association and other organizations, has returned to his office in Washington, D. C., after an extended trip through the Middle Western and Mid-Continent districts.

W. T. Deacon of St. Louis, representative of the St. Louis Surfacer and Paint Company, made a trip through the Mid-Continent refining field the last of August.

T. M. Harwood, district manager of the Youngstown Boiler and Tank Company, was in Tulsa the first part of September in connection with the opening there of a branch office of the company at 805 Mayo building.

S. R. Lawing, 39, crude buyer and representative for the White Eagle Oil and Refining Company in the North Texas district with headquarters at Wichita Falls, died September 12 from blood poison, following an operation for tonsilitis while visiting the company's offices at Wichita, Kansas.

G. C. Lucker, field engineer for the National Supply Company with headquarters at Fort Worth, and well known among the natural gasoline manufacturers and refiners in the Southwest, took two weeks off early in September for a real vacation and rest.

natural gasoline

grade "a"

GRAVITY.....Not below 72° Be.
Not above 78° Be.
E. P.....Not over 375° F.
RECOVERY.....Not less than 90%

grade "b"

GRAVITY.....Not below 76° Be.
Not above 82° Be.
E. P.....Not over 375° F.
RECOVERY.....Not less than 85%

grade "c"

GRAVITY.....Not below 80° Be.
Not above 86° Be.
E. P.....Not above 350° F.
RECOVERY.....Not less than 78%

grade "d"

GRAVITY.....Not below 88° Be.
Not above 92° Be.
E. P.....Not above 350° F.

THE demand for Natural Gasoline is very strong. Stocks have been reduced to the daily plant production.

All good winter motor gasoline should contain a certain percentage of Natural Gasoline. The experienced auto driver wants it because it makes his engine start promptly even in the coldest weather.

Let us protect your fall and winter's supply of Natural Gasoline. Our large daily production and car supply put us in a position to serve your needs promptly at all times.

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GRAVITY.....Not below 58° Be.
Not above 62° Be.
E. P.....Not over 437° F.
RECOVERY.....Not less than 91%

grade "2"

GRAVITY.....Not below 58° Be.
Not above 62° Be.
E. P.....Not over 450° F.
RECOVERY.....Not less than 90%

grade "3"

GRAVITY.....Not below 64° Be.
Not above 66° Be.
E. P.....Not over 440° F.
RECOVERY.....Not less than 88%

grade "4"

GRAVITY.....Not under 66° Be.
Not over 70° Be.
E. P.....Not over 435° F.
RECOVERY.....Not less than 8[illegible]%

CHESTNUT & SMITH CORPORATION

GENERAL OFFICES - CHESTNUT SMITH BLDG. - TULSA OKLA.

RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE

Washington, D. C.—The following patents of interest to the oil-refining industry have recently been issued by the Patent Office at Washington:

No. 1,463,990, issued on August 7 to Edward Wilson, assignor to Wilson Engineering Company, St. Louis, Mo., a corporation of Missouri. The patent covers an oil separator, comprising a casing arranged to receive the separated oil and the separated air, a receiving chamber extending downwardly into the casing and having openings through the side wall thereof, filtering material packed around the portion of the receiving chamber having said openings and against the lower wall of said chamber, a pipe opening into the upper portion of the casing for withdrawing air, and an imperforate baffle wall extending downwardly into the casing below said receiving chamber and between said receiving chamber and the openings into said pipe.

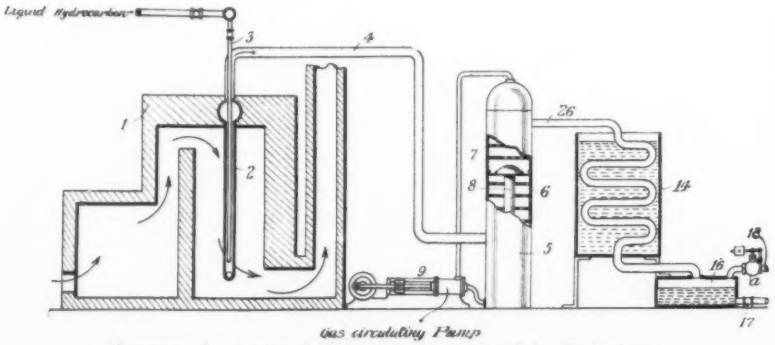
No. 1,464,152, issued on August 7 to Carleton Ellis, assignor by mesne assignments, to Seth B. Hunt, trustee, Mount Kisco, N. Y. The patent is on the process of producing light, volatile oils which comprises contacting gaseous or vaporous hydrocarbon material containing unsaturated hydrocarbons with large quantities of finely divided sulphuric acid whereby polymerization is effected to produce light, volatile oils.

No. 1,464,153, on a process of making useful products from by-product still gases and gases from cracking operations, issued on August 7 to Carleton Ellis, assignor by mesne assignments, to Seth B. Hunt, trustee, Mount Kisco, N. Y. The patent covers the process of utilizing hydrocarbon gases containing olefines for the preparation of useful products from substantially the entire olefine content thereof in which such gases are treated, while cooling, with sulphuric acid, the effective strength of which is progressively reduced during reaction to such an extent that sulphuric acid of about 1.8 specific gravity is reduced in strength until reactive acid liquor of specific gravity of not over 1.4 is obtained, and treating the residual gases with sulphuric acid of 1.8 specific gravity at a temperature above 60 degrees C., continuing the reaction until ethyl sulphuric acid of specific gravity of not over 1.4 is obtained.

No. 1,464,246, issued on August 7 to Nat Harris Freeman, Holborn, London, England, on a distilling apparatus. The apparatus is for oil and other liquids, comprising in combination a still through which the liquid passes for treatment, an internal, substantially horizontal, partition in said still dividing it into two separate superposed compartments which communicate with each other only through the partition by way of a perforation towards one end of the still, said still having in the upper compartment an outlet for distillate, and in the lower compartment an outlet for residue at the end remote from said perforation, a supply conduit for liquid communicating with the upper compartment and delivering on to the partition towards the end of the still remote from said perforations, a delivery conduit for liquid communicating with the outlet of the lower compartment, means for supplying heat to the still, and thermostatic means for automatically controlling the supply of heat to the still so as to maintain the working temperature of the still constant.

No. 1,463,990, issued on August 7 to Edward Wilson, assignor to Wilson Engineering Company, St. Louis, Mo., a corporation of Missouri. The patent covers an oil separator comprising a casing arranged to receive the separated oil and the separated air, a receiving chamber extending downwardly into the casing and having openings through the side wall thereof, filtering material packed around the portion of the receiving chamber having said openings and against the lower end wall of said chamber, a pipe opening into the upper portion of the casing for withdrawing air, and an imperforate baffle wall extending downwardly into the casing below said receiving chamber and between said receiving chamber and the opening into said pipe.

No. 1,464,918, a patent on an apparatus for treating hydrocarbons, issued on August 14 to Benjamin Andrews, Houston, Texas. It consists of a tower, comprising a liquid elevating conduit having its lower end disposed in a body of liquid in said tower, means for forcing the vapor to be treated into said conduit, near its lower end, and a member in said tower on which the liquid elevated through said conduit falls and which causes the liquid to fall in a finely divided state and thereby be brought into intimate contact with the vapors in the tower.



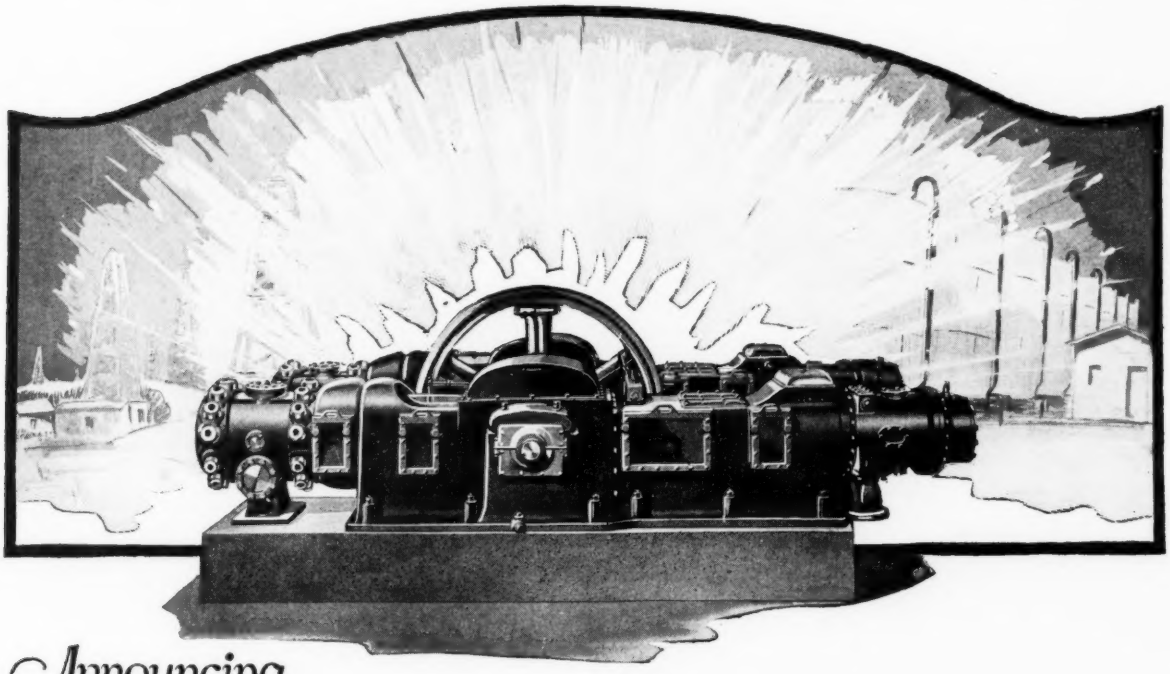
Apparatus for treating hydrocarbons just patented by B. Andrews

No. 1,465,277, issued on August 21 to John Maves and Reber Homrighous, Wichita, Kans., on an apparatus for extracting oil from shales. It comprises, in a retort of the class described, a sealed enclosure, horizontally disposed containing molten lead, a container, horizontally disposed and arranged above the enclosure and a plurality of vapor outlets leading therefrom; a pair of shafts revolvably mounted, one at either end of the container and each having crank means and paddles at spaced intervals transversely arranged within the container and depending from said bars towards the enclosure.

No. 1,465,598, on a process for the treating of hydrocarbons, issued on August 21 to Jan Heinrich Christoph de Brey, the Hague, Netherlands. It covers the process of treating mixtures of hydrocarbons containing a valuable liquid and a worthless gaseous component which comprises rectifying the mixture at a low temperature and at a superatmospheric pressure less than 20 atmospheres and correlating the pressure and the temperature range of rectification in such manner that the maximum temperature is sufficient to expel all the worthless component from the valuable component while the minimum temperature is sufficient to condense a portion of the worthless component whereby the last fractions of valuable component are washed out of the gaseous worthless component by the liquefied worthless portion thus condensed.

No. 1,465,599, on a process for treating hydrocarbons issued to Jan Heinrich Christoph de Brey, the Hague, Netherlands, issued on August 21. It describes the process of treating mixtures of hydrocarbons containing a valuable liquid and a worthless gaseous component which comprises rectifying the mixture at a pressure not less than twenty atmospheres and correlating the pressures and the temperature range of rectification in such manner that the maximum temperature is sufficient to expel all the worthless component from the valuable component while the minimum temperature is sufficient to condense a portion of the worthless component whereby the last fractions of valuable components are washed out by the gaseous worthless component by the liquefied worthless portion thus condensed.

No. 1,465,752, issued on August 21 to Robert Yates, Passaic, N. J., on a proc-



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The New Type Ten

THIS new Direct Gas Engine Driven Compressor has been perfected by Bessemer engineers and is offered to the Oil Industry after having proved its worth by meeting the most gruelling tests a compressor can undergo.

To be known as "Type Ten", this unit incorporates many refinements making it without a peer in the field. The perfected design combined with the ruggedness of Bessemer construction brings to the Oil Industry a unit to meet an exact need—the last word in compressor engineering.

Full details will be gladly sent or an engineer will call on request.

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A Few of the Many Refinements

1. All bolts and nuts readily accessible making assembly and dismantling easy.
2. Removable plate on cylinder head makes inspection and cleaning easy.
3. Longer bed permitting 5 distinct structural advantages.
4. Safety valve on cylinder head.
5. Bed plate in two units joined by outside bolting.

A Few of the Many Refinements

6. Double stuffing boxes in both power and compressor ends.
7. Air and gas valves located directly on top of the bed.
8. Readily accessible ignition system mounted directly on crankshaft.
9. Exceptionally efficient application of tie rods.

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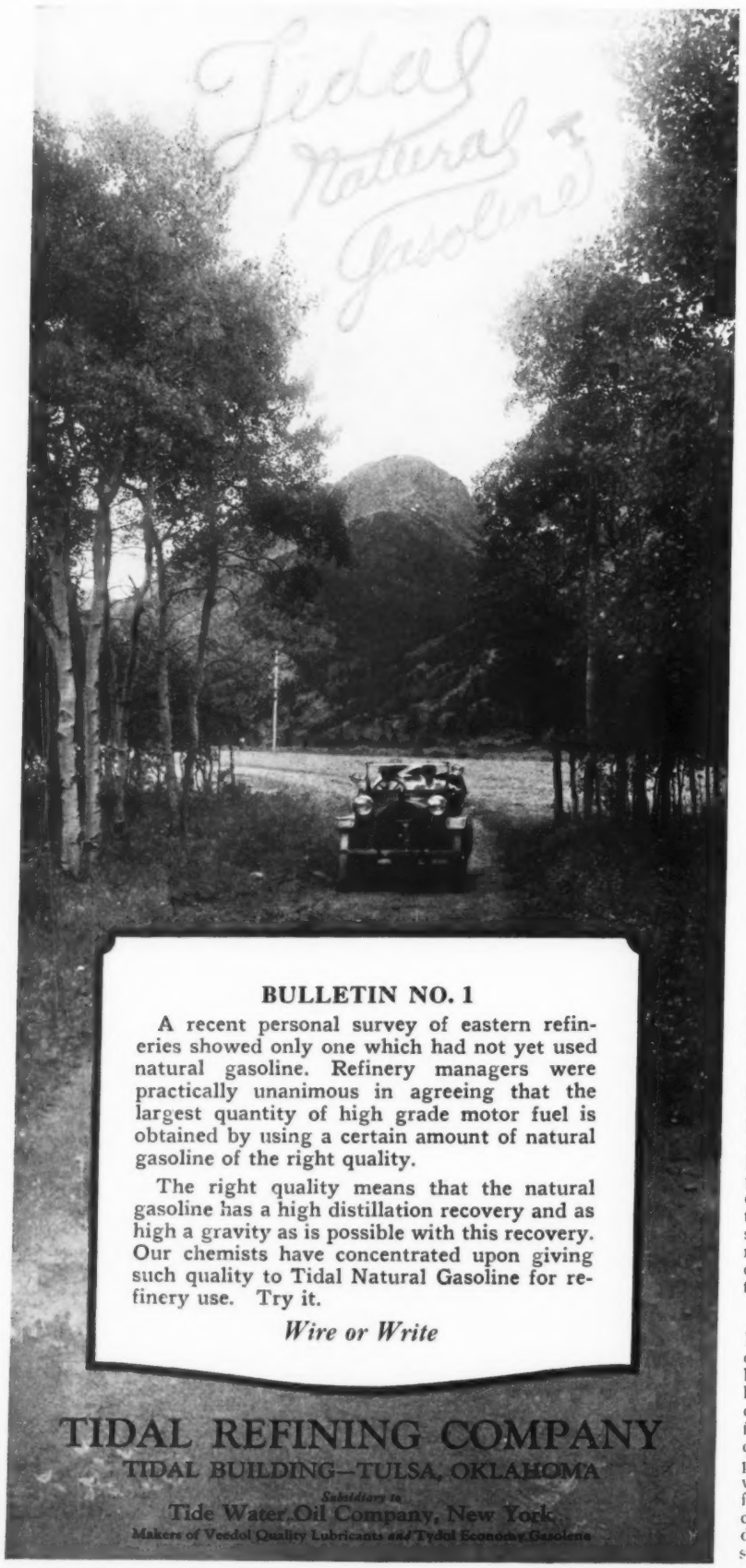

BULLETIN NO. 1

A recent personal survey of eastern refineries showed only one which had not yet used natural gasoline. Refinery managers were practically unanimous in agreeing that the largest quantity of high grade motor fuel is obtained by using a certain amount of natural gasoline of the right quality.

The right quality means that the natural gasoline has a high distillation recovery and as high a gravity as is possible with this recovery. Our chemists have concentrated upon giving such quality to Tidal Natural Gasoline for refinery use. Try it.

Wire or Write

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TIDAL BUILDING—TULSA, OKLAHOMA
Subsidiary to
Tide Water Oil Company, New York
Makers of Veedol Quality Lubricants and Tydol Economy Gasolene

ess for the manufacture of gasoline. It covers a process for manufacturing gasoline by reducing high boiling petroleum oils to lower boiling oils, comprising decomposing the oil in both oil and vapor form in cylinders, having a rotating drum within each cylinder, the oil and vapor entering the drum under vapor pressure, the vapors filling the drum and expelling the oil into an annular space between the drum and cylinder, circulating the oil around the annular space to prevent local overheating, and subjecting it to a moderate decomposing temperature in contact with the heating surface of the cylinder, also subjecting the vapors within the drum to the same moderate decomposing temperature as the oil, and for a period of time sufficient to effect decomposition, while protecting these vapors from overheating by the surrounding sheet of oil in the annular space; then reducing the vapor pressure to liberate vapors of previously held down as oil under the higher pressure and precipitating unvaporized high boiling oils and asphaltic residue out of the vapors into a vaporizing cylinder, and maintaining a vaporizing temperature therein to vaporize these high boiling oils; drawing off the asphaltic residue from this cylinder and conducting the vapors of both high and low boiling oils to a separator.

No. 1,466,208, issued on August 28 to Harold C. Eddy, assignor to Petroleum Rectifying Company of California, San Francisco, Calif., a corporation of California, on a rotating electrode closed treater for petroleum emulsions.

It covers a treater for petroleum emulsions comprising a tank; a cover closing the top of said tank; means for maintaining a fluid pressure on said tank; a vent pipe through which gases are permitted to escape from said tank; means for producing an electric field in said tank; and means for interrupting said field whenever the fluid pressure is reduced in said tank.

No. 1,466,221, issued on August 28 to John Preston Foster and Albert F. Misener, Paia, Territory of Hawaii, on a continuous distilling apparatus. The patent describes, in a continuously operating still, a distilling column inclined at an angle between the perpendicular and horizontal and comprising a series of successively communicating chambers for the downward flow of liquid therethrough, each of said chambers having a horizontally disposed floor to provide an extensive bubbling surface, each floor having a capped opening for the upward flow of vapor through the successive chambers, and means for maintaining liquid at a level in each chamber to effect normally a seal for the capped floor-opening.

No. 1,466,511, issued on August 28 to Frank Pfeifer, Minneapolis, Minn. It covers, in a cracking furnace, the combination of a wagon top outer shell having an internal combustion chamber extending its full length with a smoke flue leading from the rear end of said combustion chamber out to the atmosphere through the forward end of said wagon top shell, a charging door at the forward end of said shell above said combustion chamber, and cleanout doors in the sides of said wagon top shell.

"NEAREST the FIELD"

That is our slogan, because—

We are centrally located in Kansas City with its thirteen trunk lines and thirty-two railroads.

We offer from two to three day deliveries in Oklahoma and Northern Texas, and five to six days on the gulf.

We can make immediate shipment on 5000 to 55,000 barrel tanks completely fabricated.

Kansas City Structural Steel Co.

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Services Available for the Oil and Gas Industry As:

CONSULTING ENGINEERS in all matters pertaining to:

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Recovery of Gasoline by Absorption or Compression
Compressing and Booster Plants
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Compressing and Booster Plants
Gasoline Recovery Systems, Absorption and Compression
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No contract too large to complete with satisfaction and dispatch or too far away to handle.

MANUFACTURERS and DISTRIBUTORS of Gas and Oil Specialties, including:

Heat Exchangers
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Compressing and Booster Station Equipment
Reeves Vertical Gas Engines and Compressors
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Consulting and Contracting Engineers in Natural Gas and Oil.

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MID-CONTINENT REFINER OPERATIONS

As of September 15, 1923

ARKANSAS

Plant and Location—	Capacity	Now Running
Abner Davis, El Dorado	60	SD
Airedale Refining Co., El Dorado	1,000	SD
Arkansas Refining Co., Fort Smith	1,000	SD
Arkansas Pro. & Ref. Co., El Dorado	1,000	500
El Dorado P. L. & Ref. Co., El Dorado	2,000	SD
Farmer Oil & Ref. Co., Texarkana	1,000	200
Four States Refining Co., Texarkana	400	SD
Grison Refining Co., El Dorado	750	SD
Jones Brothers & Tatum, El Dorado	1,000	400
Kettle Creek Refining Co., Pearson	2,000	1,500
Lion Oil & Ref. Co., El Dorado	12,000	7,000
Pine Bluff Refining Co., Pine Bluff	1,500	1,200
Root Refineries, El Dorado	3,000	1,500
Shippers Petroleum Company, El Dorado	1,800	500
The Arkansas Refining Co., Riodron	3,000	SD
Union P. L. & Ref. Co., El Dorado	4,000	500
Total for Arkansas	35,460	13,300

KANSAS

Associated Pro. & Ref. Co., El Dorado	1,000	SD
Bell Producing & Ref. Co., Wichita	700	SD
Commonwealth Oil & Ref. Co., Moran	800	150
Derby Oil & Refining Co., Wichita	5,000	SD
Chemical Oil & Gas Co., Osawatomie	1,000	SD
El Dorado Refining Co., El Dorado	4,000	1,700
Frontier Refining Co., Hutchinson	2,000	SD
Golden Rule Refining Co., Wichita	800	700
Great Western Petroleum Co., Florence	2,000	SD
Great Western Refining Co., Erie	1,500	SD
H. & H. Refining Co., Osawatomie	1,000	SD
Industrial Refining Co., El Dorado	1,500	SD
Kanotex Refining Co., Arkansas City	3,000	1,400
Kansas City Refining Co., Kansas City	5,000	4,000
Kansas Oil Refining Co., Coffeyville	2,000	400
Kansas-Texas Oil Ref. Co., Wichita	1,500	SD
Interstate Refineries, Inc., Centropolis	1,000	200
Lesh Refining Co., Arkansas City	1,500	900
Lakeside Refining Co., Augusta	2,500	500
Midland Refining Co., El Dorado	12,000	10,000
Mutual Oil Co., Chanute	1,500	400
Mecca Refining Co., Augusta	2,500	SD
Marshall & Company, Sheffield	2,500	SD
Moore Refining Co., Arkansas City	4,500	4,000
Mo-Kan Refining Co., Kansas City	1,000	SD
McCree Petroleum Company, Baxter Springs	600	SD
McWhorter-Chanute Ref. Co., Chanute	200	SD
Miller Petroleum Company, Humbolt	1,500	SD
National Refining Co., Coffeyville	5,000	4,500
North American Ref. Co., Rosedale	700	SD
Peerless Oil & Ref. Co., Chanute	2,500	1,200
Richardson Refining Co., El Dorado	2,000	500
Red Bird Refining Co., Fredonia	800	400
Sinclair Refining Co., Argentine	6,000	5,000
Sinclair Refining Co., Coffeyville	7,000	4,800
Sterling Oil & Ref. Co., Wichita	5,000	2,800
Standard Oil Co. (Kansas), Neodesha	12,000	6,000
Uncle Sam Oil Co., Argentine	700	SD
Uncle Sam Oil Co., Cherryvale	2,400	SD
Vickers Petroleum Co., Potwin	1,800	800
White Eagle Oil & Ref. Co., Augusta	6,000	6,000
Total for Kansas	116,200	55,850

LOUISIANA

Caddo Central Oil & Refining Co., Shreveport	3,500	SD
Caddo Central Oil & Refining Co., Shreveport	7,000	5,000
Crescent Oil & Refining Co., Cedar Grove	800	SD
Homer Refining Co., Homer	250	SD
International Oil & Ref. Co., Shreveport	800	SD
Leeton Refining Co., Shreveport	800	SD
Louisiana Pet. Prod. Co., Bossier	300	D
Louisiana Oil & Ref. Co., Shreveport	9,000	5,000
Paramount Pet. Co., Superior	3,000	SD
Red River Refining Co., Crichton	1,500	SD
Rogers Refining Co., Shreveport	1,500	SD
Shreveport Oil & Ref. Co., Shreveport	4,500	4,000
Texas Company, Arlda	5,000	5,000
Union Ref. & P. L. Co., Oil City	1,000	SD
Union Ref. & P. L. Co., Homer	1,000	SD
Total for Louisiana	39,950	19,000

MISSOURI

Saint Joseph Viscosity Oil Co., St. Joseph	500	RRC
Standard Oil Co., (Indiana) Sugar Creek	12,000	6,000
Wilhoit Refining Co., Joplin	2,000	800
Total for Missouri	14,500	6,800

OKLAHOMA

Plant and Location—	Capacity	Now Running
Acme Refining & P. L. Co., Jennings	2,600	SD
Allied Refining Co., Okmulgee	2,000	500
Associated P. & R. Co., Yale	1,000	SD
Barnsdall Refining Co., Barnsdall	3,000	2,600
Bay State Refining Co., Healdton	1,000	SD
Beaver P. & R. Co., Dilworth	700	SD
Bison Refining Co., Quay	1,000	SD
Bolene Refining Co., Enid	3,600	1,500
Bristow Gasoline & Sup. Co., Bristow	400	SD
Buffalo-Refining Co., Yale	1,000	SD
Cushing Refining Co., Cushing	1,000	SD
Cameron Refining Co., Ardmore	3,500	2,500
Canfield Refining Co., Yale	500	200
Carter Oil Co., Cartoco	12,000	SD
Champlin Refining Co., Oilton	1,000	SD
Chestnut & Smith Corp., Sand Springs	5,000	SD
Choat Oil Corp., Oklahoma City	2,000	SD
Coleman-Nelson Corp., West Tulsa	2,000	SD
Coleman-Nelson Corp., Haskell	1,000	SD
Constantine Refining Co., Devol	10,000	SD
Constantine Refining Co., West Tulsa	4,500	SD
Cosden & Company, West Tulsa	35,000	8,000
Cushing Ref. & Gasoline Co., Cushing	2,500	1,500
Cyril Refining Co., Cyril	1,200	400
Daisy Bell Petroleum Co., Wilson	2,000	400
Damascus Refining Co., Lawton	1,500	SD
Cushing Ref. & Gaso. Co., Blackwell	1,500	1,200
El Dorado Refining Co., Yale	700	SD
Equality Refining Co., Oilton	1,000	SD
Empire Refineries, Inc., Cushing	5,000	3,400
Empire Refineries, Inc., Okmulgee	2,500	1,750
Empire Refineries, Inc., Oklahoma City	2,500	SD
Empire Refineries, Inc., Ponca City	4,500	3,400
Francis Refining Co., Francis	5,000	SD
Frederick Refining Co., Frederick	5,000	SD
Fairmont Refining Co., Fairmont	2,500	800
Federal Oil & Ref. Co., Cushing	1,500	SD
Globe Oil & Ref. Co., Blackwell	4,000	2,500
Gilmer Oil Company, Ringling	800	200
Golden Belt Refining Co., Oklahoma City	200	SD
Grandfield Oil & Ref. Co., Grandfield	3,000	1,500
Great American Refining Co., Jennings	2,500	SD
Hewitt Refining Co., Hewitt	1,600	1,000
Home Oil & Refining Co., Yale	2,000	SD
Indian Chief Refining Co., Cushing	1,800	SD
U. S. Cities Corp., Bristow	2,500	300
Imperial Refining Co., Ardmore	5,000	4,000
Indiahoma Refining Co., Okmulgee	9,000	3,000
Illinois Oil Co., Cushing	3,000	1,450
Inland Refining Co., Cushing	3,000	SD
Johnson Oil Refining Co., Cleveland	2,500	1,600
Lawton Refining Co., Lawton	1,000	SD
Livingston Refiners Corp., Walters	3,000	SD
Local Refining Co., Oklahoma City	1,000	400
Marland Refining Co., Ponca City	12,000	5,000
Marland Refining Co., Covington	1,000	600
Mecca Refining Co., Allen	1,500	SD
Meridian Refining Co., Okmulgee	3,000	SD
Meridian Refining Co., Hominy	1,000	SD
Meridian Refining Co., Ponca City	2,500	SD
Mid-Co Petroleum Co., West Tulsa	7,000	SD
North American Ref. Co., Pemeta	1,500	SD
Nyanza Refining Co., Wilson	3,500	700
Oil State Refining Co., Enid	2,500	800
Pontotoc P. L. & Ref. Co., Allen	600	200
Omar Refining Co., Garber	2,500	1,000
Oklahoma Prod. & Ref. Co., Muskogee	2,500	SD
Pawhuska Refining Co., Pawhuska	1,000	SD
Waite Phillips Co., Okmulgee	4,000	3,000
Pierce Oil Corp., Sand Springs	9,000	5,000
Polar Prod. & Gasoline Co., Sapulpa	2,000	SD
Producers & Refiners Corp., Blackwell	2,500	2,000
Producers & Refiners Corp., West Tulsa	6,000	4,200
Pure Oil Company, Ardmore	7,000	3,000
Pure Oil Company, Cushing	6,500	3,200
Pauline Refining Co., Hampton	1,200	SD
Powerine Oil Co., Billings	500	SD
Pioneer Petroleum Co., Guthrie	2,500	SD
Sheridan Refining Company, Newkirk	2,000	SD
Rock Island Ref. & P. L. Co., Duncan	1,200	900
Santa Fe Oil & Ref. Co., Ardmore	5,000	SD
Shaffer Oil & Ref. Co., Cushing	6,500	3,200
Sapulpa Refining Co., Sapulpa	7,000	1,600
Southern Oil Corp., Yale	6,000	SD
Southern Oil Corp., Walter	2,500	SD
Sun Company, Yale	4,500	2,200
Southwestern Oil Corp., Enid	1,800	SD
Sinclair Refining Co., Cushing	5,500	5,000
Sinclair Refining Co., Muskogee	2,000	800
Texas-Okla. Refining Co., Grandfield	1,500	1,200
Texas Company, West Tulsa	8,000	6,000
Texas-Pacific Coal & Oil Co., Wynnewood	5,000	1,500

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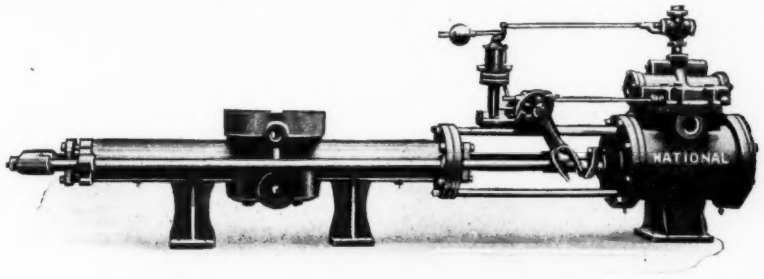

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REFINERY AND GASOLINE PLANT ACTIVITIES

Western Refiners to Move Executive Office to Tulsa

Kansas City, Mo.—Announcement of the removal to Tulsa, Oklahoma, of the executive offices of the Western Petroleum Refiners Association from this city is made by Howard Bennette, secretary, who advises that the removal will be made as of September 15. Space has been obtained in the Cosden building in Tulsa and adjoins the space occupied by the Mid-Continent Oil and Gas Association.

A. T. Sindel has resigned as traffic manager of the Refiners Association and P. A. Conway has been named commerce counsel and traffic manager, effective November 1. The office of commerce counsel and traffic manager will be maintained at 304 Interstate building in Kansas City until that date.

It also is announced that Fayette B. Dow of Washington will continue in the capacity of counsel and assistant in traffic matters coming before the Interstate Commerce Commission. Ed P. Byars of Fort Worth, Texas, will continue as the Texas traffic representative of the association. H. K. Davis and assistant, E. H. Ritter, will continue in charge of the statistics.

The car tracing department will maintain offices at 800 Orear-Leslie building in Kansas City and will be in charge of M. A. Sticelber.

Kansas City, Mo.—Operations at the $3,500,000 plant of the Lion Oil and Refining Company at El Dorado, Arkansas, are expected to begin around September 1. With 19 stills the plant will have a potential capacity of 10,000 barrels. Smackover, Arkansas, crude will be run through the plant.

New Process Will Be Tried By Oriental Oil at Dallas

Dallas, Texas.—One of the three cracking units being installed by the Oriental Oil Company in its refinery at Oriental station, near Dallas, has been placed in operation, while the remaining two are expected to be completed early in October. This cracking process was perfected by F. M. Floyd, refinery superintendent, and each unit has an estimated capacity of 150 barrels daily. No information is available at present as to the recovery obtainable through the use of this process. The cracking units are in Oriental's original plant, which also includes a complete lubricating oil and grease manufacturing system. The 3500 barrel daily capacity skimming plant, operated within the past four years by Eastland Oil and Refining Company, Aetna Oil Corporation and Trinity Oil Corporation, which was purchased last year by Oriental Oil Company, is now being used by Oriental to skim the crude oil of its light contents, while the by-products are piped over to the combination lube and cracking plant. Oriental's refined products are largely retailed through its own filling stations in Dallas and nearby cities.

Oklahoma Concern Builds New Lubricating Plant

Tulsa, Okla.—A plant for the manufacture of lubricating oils is being constructed at Joe station on the Sand Springs railroad near here by the Missouri Valley Refining Company, which has been operating in Oklahoma since 1921. The plant is expected to be in operation by October 15 with a daily capacity of around 600 barrels. Officers of the company are located at 605 Kennedy building in Tulsa. J. T. Bradley, Jr., is president of the Missouri Valley Refining Company; J. T. Owens, formerly of the Standardized Lubricants Company of Tulsa, is vice president. E. O. Monnet is secretary an J. T. Reid, treasurer.

To Build Refineries and Gasoline Plants in Mexico

Washington, D. C.—The assistant trade commissioner at Mexico City has reported to the Petroleum Division of the Department of Commerce that a concession has been granted for the installation of plants for the extraction of gasoline and natural gas. The concessionaire is Manuel Gomez, a Spanish subject.

This concession, it is declared, is in accordance with the policy laid down in the decree of November 22, 1922, requiring oil companies to make use of the natural gas flowing from oil wells, which was formerly wasted in most cases. According to the terms of the concession, the concessionaire agrees that a sufficient number of plants will be installed within a period of five years to produce at least 25,000 cubic meters of gasoline per year. This concession is said to be in addition to a similar one granted to another party on November 28, last, which has not yet expired. It is said, however, that there will be no conflict between the terms of the two concessions and it is hoped that the carrying out of their terms will result in a reduction of the domestic price of gasoline

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F. A. Pielsticker, recently elected vice president of the Skelly Oil Company, in charge of refining operations, will continue his offices at Eldorado, Kansas.

Plant and Location—	Capacity	Now Running
Travis Senter Refining Co., Comanche	1,500	800
Twin Six Oil & Ref. Co., Grandfield	2,500	1,500
Turley Refining Co., Oklahoma City	2,500	SD
Wagoner Refining Co., Wagoner	500	SD
Wilcox Refining Co., Bristow	500	500
Yale Oil Corporation, Yale	1,200	600
Oklahoma total	341,600	117,400
TEXAS		
American Oil Corp., Pioneer	2,500	1,000
American Refining Co., Wichita Falls	5,000	4,500
H. E. Boner, Burkburnett	700	SD
The Petroleum Corp., Electra	2,000	500
Buffalo Refining Co., Sherman	500	100
Burk-Texas Refining Co., Burkburnett	1,200	SD
Bear Refinery Co., Burkburnett	1,200	SD
Clayton Oil & Ref. Co., Dallas	3,500	1,500
Crystal Petroleum Co., Burkburnett	1,000	300
Eastland-Pioneer Oil & Ref. Co., Cisco	1,000	SD
Empire Refineries, Inc., Gainsville	7,000	3,850
General Refineries, Inc., Abilene	1,500	SD
Gulf Refining Co., Fort Worth	15,000	4,500
Gorman Refining Co., Gorman	1,000	SD
Griswold Refining Co., Electra	2,000	1,000
Humble Oil & Refining Co., Burkburnett	1,500	1,000
Invincible Oil Corp., Fort Worth	5,000	SD
Interstate Gasoline Co., Iowa Park	2,000	300
Iowa Park Prod. & Ref. Co., Iowa Park	1,000	400
Keystone Ranger Refining Co., Wichita Falls	2,000	SD
Lone Star Refining Co., Wichita Falls	4,000	SD
Manhattan Pet. Prod. Co., Wichita Falls	2,500	300
Miller Petroleum Co., Wichita Falls	2,500	1,200
Magnolia Petroleum Co., Fort Worth	12,500	5,000
Noble Oil & Gas Co., Burkburnett	5,000	SD
Nortex Refining Co., Burkburnett	2,000	300
North Texas Refining Co., Greenville	1,000	SD
Owenwood Oil Corp., Burkburnett	2,000	SD
Oriental Refining Co., Dallas	5,000	500
Oddessa Refining Co., Ranger	1,000	SD
Orient Petroleum Co., Wichita Falls	2,000	300
Pierce Oil Corp., Fort Worth	10,000	SD
Panhandle Refining Co., Wichita Falls	4,500	2,800
Associated Pro. & Ref. Corp., Fort Worth	2,000	SD
Primrose Refining Co., Wichita Falls	1,500	300
Interstate Refineries, Inc., Ranger	2,500	SD
Haggeman Refining Co., Tiffin	2,000	400
Star Refining Co., Fort Worth	1,500	200
State Refining Co., Dallas	1,000	200
Sunshine State Refining Co., Wichita Falls	2,500	1,500
Tidal Western Refining Co., Burkburnett	3,000	2,000
Texas Company, Dallas	15,000	7,400
Texhoma Oil & Ref. Co., Wichita Falls	4,500	2,500
Transcontinental Oil Co., Fort Worth	5,000	2,500
Travis Refining Co., Burkburnett	1,000	SD
Great Texas Refining Co., Deleon	700	SD
Uniform Petroleum Co., Burkburnett	4,000	SD
Virginia Refining Co., Dublin	4,000	SD
Victor Refining Co., Burkburnett	2,000	SD
Wagoner Refining Co., Electra	2,000	600
Walker Consolidated Ref. Co., Iowa Park	2,500	SD
White Eagle Oil & Ref. Co., Fort Worth	5,000	3,000
Waco Refining Co., Waco	5000	SD
World Refining Co., Bridgeport	800	SD
Texas total	173,100	49,900

A single "Western" Engine has often changed the complete power policy of a large company.

WESTERN MACHINERY COMPANY

Three Companies Now Using 26,000 h.p. In Compressor Plant Service Alone~

The history of "WESTERN" gas engines wherever they are "tried out" on the basis of efficiency, economy and dependability records the constant addition of "WESTERNS" as power requirements increase.

Three oil and gas companies starting with a single "WESTERN" on trial now are using 26,000 H. P. in compressor plant service alone. And this is not an isolated nor exceptional instance.

There are reasons for standardization of power equipment when fuel and lubricating economies, low maintenance costs and dependable performance, such as "WESTERN" Gas Engines deliver, are the result.

"WESTERN" records of performance, operating and maintenance costs are open to anyone interested in power equipment for oil country service—for comparison or any other purpose, without the slightest obligation.

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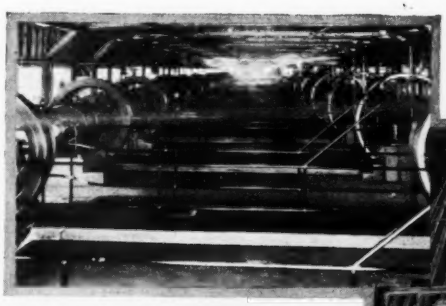

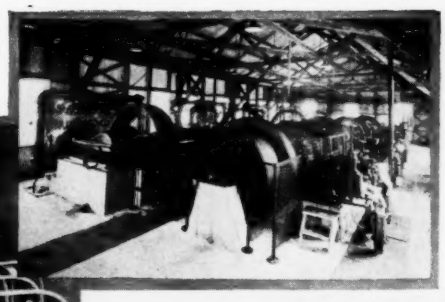

WESTERN

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Plans Made for Another Plant at New Powell Pool

Corsicana, Texas.—Another natural gasoline manufacturing plant is proposed for the Corsicana-Powell field. The Pure Oil Company, which purchased full control of the Humphreys Oil Company's producing properties on September 1, has announced that it will probably start construction work this month on an absorption plant to be located on Humphreys' R. I. Kent 44-acre lease in the southwest part of the field. No details have been made public as to the probable size and cost of the plant. It will be located only a short distance from the five million cubic foot absorption plant announced last month as being constructed by the Humble Oil and Refining Company at an estimated cost of $250,000, and the gas in this immediate territory tests about two gallons of gasoline per thousand cubic feet. The Humble plant is the first to be started in the field.

Small Plant at Rockdale Complete and Operating

Rockdale, Texas.—The small topping plant recently completed by the Austin Petroleum Company at Tracey in the Rockdale-Minerva field, Milam County, is now in operation. This plant has a daily capacity of about 65 barrels of crude, and is running on the company's own shallow production and a few adjoining leases. Headquarters of the company are located at 627 Littlefield building, Austin, Texas, with the following officers: Col. A. C. Baldwin, president; Judge Caves, assistant attorney general of Texas, secretary-treasurer; and Joe W. Taylor, manager of plant.

Small Gasoline Plant Is Built in Southern Utah

Aztec, N. M.—A small plant for refining crude has been constructed by the Mexican Hat Oil Company near the town of Bluff on the San Juan River in the southeastern corner of Utah and the company is prepared to handle oil from the Four States field. The Navajo Indian council is working to have the Midwest Refining Company erect a refinery to take care of the field's output in the event production is maintained in quantity.

Dallas, Texas.—The sulphuric acid plant recently moved from Sugarland, Texas to this city by the United Chemical Company began operating full capacity July 27, and is making a specialty of acids and other chemicals used by refineries, cracking and skimming plants in the Mid-Continent oil fields. The plant has a daily capacity of 30 tons, and is located on the Eagle Ford road. Headquarters are maintained in the Magnolia building in Dallas, with Joe Barlow in charge of sales.

Mid-Kansas to Start Work On New Gasoline Plant

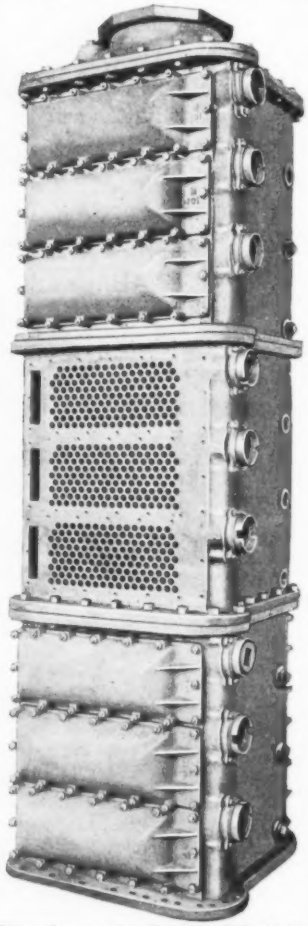
Breckenridge, Texas.—Construction work on a 9,000,000 cubic foot natural gasoline plant to be located on the Hill lease in Eliasville section of Stephens County is to be started shortly by the Mid-Kansas Oil and Gas Company of Mineral Wells and Findlay, Ohio. Materials for this plant were purchased last spring, but actual construction was held up because of condition of the natural gasoline market. The plant will consist of six units, using the absorption process, and when completed will represent an investment of approximately $235,000. The gas to be used by the plant is reported to test about one and a quarter gallons of gasoline per 1000 cubic feet.

Complete Refinery to Be Built by New Texas Firm

Dallas, Texas.—Construction work on a complete refinery to be located at West Dallas near here is to be started during the next 30 days by the Thrift Oil Refining Company. The plant will have a daily capacity of 500 barrels of crude oil, and will be equipped with the F. M. Floyd cracking process, besides having a grease and lube oil manufacturing system. F. M. Floyd, who has been general plant superintendent for the Oriental Oil Company's plant at Dallas for the past seven years, is one of the organizers of the new concern, which will be incorporated shortly. According to Mr. Floyd, the plant will cost approximately $80,000 when completed. Temporary headquarters of the Thrift Oil Refining Company are maintained at 206 North Winnetka avenue, Dallas, Texas.

Type B-540 Gasoline Condenser
(Patented)

Compact — Efficient — Flexible



Dimensions — overall, 30" x 30" x 9'-0"
(inc. top and bottom bonnets)

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For eighteen years, as the "Tulsa Boiler and Sheet Iron Works" we have turned out tanks and refinery steel construction that made good friends for us among the wise buyers of the Mid-Continent. We pioneered in giving these people "close to home" service on the best kind of work.

Now, under the new name, The Pioneer Tank and Boiler Company, we're all set with the men, machinery and money to keep on growing under the Pioneer banner like we did when Tulsa Boiler and Sheet Iron was on our letterhead.

There is no change in our organization.

Get Pioneer quotations on tank and refinery construction work.

PIONEER TANK & BOILER COMPANY
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Take for instance 20 gravity Smackover crude

Think of running 1000 bbls. daily, direct to a double Dubbs Cracking unit and getting more than 350 bbls. of good Navy IBP-EP gasoline each day from one throughput; and the cracking costs but little more than skimming—if there were anything to skim out of 20 gravity Smackover

The residuum that is left after cracking out the gasoline, is freer flowing and has more BTU's than the original crude

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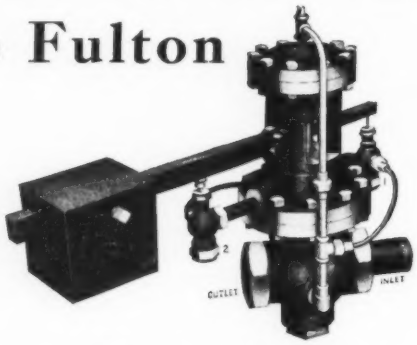

Gas Relief Valve

Weights can be adjusted accurately to operate at point of compression desired.

Automatically allows treated gas to escape as soon as all of the gasoline is removed from it, at the same time admitting a fresh supply of untreated gas.

We will furnish list of installations in your vicinity so you may see it operate. Write us for bulletins regarding our line of gas regulators.

The Chaplin-Fulton Mfg. Co.

30 Penn Ave., Pittsburgh, Pa.

STANDARD
AND EXTRA HEAVY CAST IRON
PIPE FITTINGS

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"UNITED"

Products have fully demonstrated their ability to withstand any usage within the pressure limits for which they are designed.

We manufacture pipe fittings of all kinds and will be glad to quote you on your requirements.

UNITED IRON WORKS, Inc.

TULSA KANSAS CITY, MO. DALLAS

Refiners to Get Together At Tulsa October 9 and 10

Kansas City, Mo.—A semi-annual business meeting of the Western Petroleum Refiners Association will be held in the assembly rooms of the Mid-Continent Oil and Gas Association in the Cosden Building in Tulsa, October 9 and 10. The call for the meeting which is to convene the opening day at 1 p.m. has been sent out by Howard Bennette, secretary.

The meeting has been arranged so as to enable refiners to attend the International Petroleum Exposition and Congress in Tulsa, as well as attending to their own business affairs.

Combination Plant Is Latest for Louisiana

Monroe, La.—The Central Carbon Company of Clarks, Louisiana, of which A. W. Johnson is president, has started construction work on a combination natural gasoline and carbon manufacturing plant. The plant site is near Clarks in the Monroe gas field, and when completed the plant will have a daily capacity of about 10,000,000 cubic feet of gas. The absorption process will be used in extracting the gasoline from the gas.

Pittsburgh Firm Is Now Operating Crystal Plan.

Breckenridge, Texas.—The natural gasoline manufacturing plant owned by the Central Gasoline Producing Company on the W. P. Newell lease in the Ivan district of Stephens County is now being operated and under the full management of the Gas Engineering Construction Company, which has offices at Pittsburgh, Tulsa and Casper, Wyoming. W. G. Cummings of Tulsa, president of the Gas Engineering Construction Company, is at present giving his personal attention to the operation of the plant, which has lately increased its gasoline output.

Properties of Jennings Plant Will Be Salvaged

Jennings, Okla.—The plant here of the Great American Refining Company, financed and erected during the war-time period, has been bought in at public auction by the First National Bank of Tulsa, which plans to salvage the property. The sale price was $23,500 and delinquent taxes amounted to about $15,000.

New Gasoline Plant to Be Built by Magnolia

Desdemona, Texas.—The Magnolia Petroleum Company is making preparations to begin construction work on another natural gasoline manufacturing plant to be located in the Desdemona-Gorman district. The plant will be on the M. T. Harrell farm in T. Tyler survey, and will have a daily capacity of about 2,000,000 cubic feet of gas. It will be made up into three units, and the casing head process will be used.

Oklahoma City, Okla.—Livingston Refiners Corporation of Tulsa and Chicago has filed notice of withdrawal from the state.

Eastern Refinery to Use Crude From California

Braintree, Mass.—The refinery here recently acquired by the H. L. Doherty interests is to be operated on crude bought from the West Coast, according to information here. H. R. Straight of Bartlesville, Oklahoma, an official of the Doherty organization has just completed a trip to California and it is understood has contracted for a supply of crude for the Braintree plant.

Wichita Falls, Texas.—Having operated full capacity lately entirely on its own production, which is being materially increased by development of a new pool in Archer County, the Sunshine State Oil and Refining Company has announced that another 500-barrel daily capacity still will be added to its skimming plant located north of Wichita Falls. The plant now has a capacity of about 2500 barrels daily, and has direct connections by pipe line to the producing properties.

El Dorado, Ark.—The Marr Oil Corporation has placed an order with the Gas Engineering and Construction Company of Tulsa, Oklahoma, for three 80 horsepower Clark direct driven gas engine compressor units. These machines are to be installed at the company's gasoline plant at Griffin, Arkansas.

Washington, D. C.—A 1-cent levy on gasoline to be collected all over the United States likely will be attempted at the next session of congress. The tax would be in addition to the consumption tax now in effect in more than 30 states and it is estimated the levy would bring in something like $50,000,000.

A. P. I. Men Discuss Safety Sampling Rule

Atlantic City, N. J.—The proposed safety rule for "sampling" tank cars before placement came up for discussion at a meeting of the general committee on railroad transportation of the American Petroleum Institute held at the Traymore Hotel here August 29 and 30. The meeting was called by H. E. Felton, chairman. The various subcommittees submitted reports and several important subjects were taken under consideration.

New York, N. Y.—Plans for the Marcus Hook, Pennsylvania, refinery of Sinclair Consolidated are well under way and the company has announced that its plants at East Chicago and at Houston are to be enlarged.

Chicago, Ill. — Barnsdall Refining Company posted notice at their plant at Barnsdall, Oklahoma, that effective September 1 the wages of all employes would be reduced 10 per cent. Mounting operating costs and low prices for finished oils was given as the reason.

Oklahoma City, Okla.—A charter has been granted the Lorraine Refining Company of Delaware, which has $25,000 invested in Oklahoma and maintains an office at Tulsa.

Wellsville Refinery Is Taken Over By Sinclair

Wellsville, N. Y.—The plant here of the Wellsville Refining Company has been taken over by Sinclair Consolidated. The refinery was originally financed with local capital and was purchased by the Union Petroleum Company before the company became a part of the Sinclair organization.

Casper, Wyo.—The Texas Company has contracted for the erection of four new 80's at the tank farm adjoining the company's refinery here. Erection of the storage is part of the company's expansion program for the mountain section.

West Tulsa, Okla.—Cosden and Company's refinery here has resumed operations after a rest period extending from August 1. The plant is running about 10,000 barrels of crude daily to stills.

Pittsburgh, Pa.—New equipment orders placed with steel interests here and in the West include five tank cars of 8000 gallon capacity for the Bradford Gasoline Company with the General American Tank Car Company and 200 tank cars of 12,500 gallon capacity for the Union Pacific railway with the Standard Tank Car Company. The Texas Company is inquiring for 10 tank cars of 6000 gallons capacity.

Chicago, Ill.—Effect of the present unsatisfactory condition of the refined oil market is seen in the announcements made by Standard Oil Company (Indiana) and Roxana Petroleum Company of the laying off of men at their refineries at Wood River, Illinois.

Gasoline Association Has Brochure of 2nd Meeting

Tulsa, Okla.—The Association of Natural Gasoline Manufacturers through the office of A. V. Bourque of this city, secretary of the organization, has issued an attractive and interesting 92-page brochure containing the entire proceedings of the association's second annual convention held in Tulsa in April.

Wood River, Ill.—Additions to the Roxana Petroleum Company's refinery here and the construction of a new lubricating oil plant are projects under consideration by company officials.

San Francisco, Calif.—Approximately $250,000 damage was done by the recent fire at the Standard Oil Company (California) tank farm at San Pablo in this state.

New York, N. Y.—The contract to furnish Todd oil burners and necessary equipment for the conversion of the White Star liner Homeric from coal to oil burning has been awarded the London company of Todd Shipyards Corporation by Harland and Wolff of Belfast. It is planned to do the work in October in Belfast.

Oklahoma City, Okla.—Figures in the state auditor's office indicate that for the first two months of Oklahoma's one cent gasoline tax there was received $170,000.

Los Angeles, Calif.—It is understood here that the Japanese navy has recently closed a sizeable contract for fuel oil approaching 3,000,000 barrels.

Little Rock, Ark.—The amount collected from the 3 cent gasoline levy in Arkansas during July was $145,391.

POSITIONS WANTED—MEN WANTED

As a service to its readers The Refiner and Natural Gasoline Manufacturer has started this section where men open for positions and companies wanting men will be able to get together. Advertisements of this type will be carried at $1.00 per insertion, each advertiser being allowed 30 words. This 30 words to include the name and address. Advertisements carrying more than 30 words will be charged for at the rate of $1.00 for the first 10 words and 10 cents for each additional word.

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Young refiner of good training and education and thorough all-around practical experience employed at present. Address in detail "Petro," care "Refiner," Gulf Publishing Co., First National Bank Bldg., Pittsburgh, Pennsylvania.

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with oil refinery experience, topping plants and high pressure cracking plants desires connection with Southern refinery. Available September 15. Box 77, The Refiner and Natural Gasoline Manufacturer.

Electrically Driven Centrifuges
Hand Centrifuges
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WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

The Various Methods of Petroleum Refining

(Continued from page 20.)

quent removal of such oxidation products with the lye. In his patent specification is mentioned the use of a cylindrical iron or steel vessel suitably earthed as one element of an electrolytic apparatus and the use of carbon or graphite anodes. Any suitable hypochlorite such as sodium hypochlorite with an excess of free alkali may be used. The hydrocarbons to be treated may be poured into the electrolyte and electrolysis proceeds while the electolyte is actively stirred. The presence of free alkali, it is claimed, prevents corrosion of the vessel, inhibits the chlorination of hydrocarbons, stabilizes the hypochlorite, and aids in the removal of the products of the treatment which results mainly from the oxidation of the organic sulphur compounds originally present in the liquid hydrocarbon undergoing treatment. The hypochlorites may be prepared external to the treating apparatus by any known method such as electrolysis of a salt solution by passing liquid chlorine into a solution of sodium hydroxide or calcium hydroxide or simply using a suspension of bleaching powder.

Dunstan and Brooks[162] in a recently published article dealing with the application of the hypochlorite process of refining state that the method has been in successful operation for a little over one year in several refineries. They also state that two or three pounds of chlorine in the form of hypochlorite per 1000 gallons of light distillate is sufficient for most purposes, but the complete desulphurization of various gasolines, about one pound of chlorine per 50 gallons of gasoline is necessary. The electrolytic method of preparing the hypochlorite solution by the partial electrolysis of salt it appears has been abandoned and the hypochlorite solutions are now made up direct from liquid chlorine with the corresponding alkali.

Young and Peake[163] have described the use of bleaching powder for sweetening and desulphurizing gasoline on a large scale at the Mid-West Refining Company in Natrona county, Wyoming. This method has been in use, as the authors state, since 1921 for refining a natural gas gasoline blend on a commercial scale and very good results have been obtained.

Regarding the use of hypochlorite solution alone in the refining of cracked distillates, no very conclusive work has yet been done. The problem of oxidizing compounds in cracked distillates is in straight run distillates. However, it may be mentioned that cracked distillates vary considerably in composition depending upon the source of the raw oil charging stock and that the composition of some of these distillates is indeed very complex. From preliminary experiments carried on in this laboratory the authors may confidently state that the chief difficulty in the application of this method to the refining of cracked distillates lays principally in the removal of the color, that is, the production of water white gasoline.

However, by combining the hypochlorite treatment with some form of the sulphuric acid treatment, good products may be obtained and a saving of sulphuric acid may be effected.

The use of a solution of litharge in sodium hydroxide for the removal of certain types of sulphur compounds is old in the oil industry. A complete discussion of the use of these reagents in connection with the refining of cracked hydrocarbon oils has been given in a previous work on the sulphuric acid refining of such oils.

In conclusion it is pointed out once more that the present work will have served its purpose if it has brought to the reader's attention the numerous and varied methods which have been used or attempted in the refining of oils and the possibility of applying some of these methods in the refining of cracked hydrocarbon oils.

[162]Dunstan and Brooks. Ind. Eng. 14, (12) 1112 (1922).
[163]Young and Peake—Chem. & Met. 972 (1922).

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Vilter High Speed Horizontal Refrigerating Machine

Builders of Refrigerating Machinery, Oil Cooling Coils, Gasoline Condensers, Etc.

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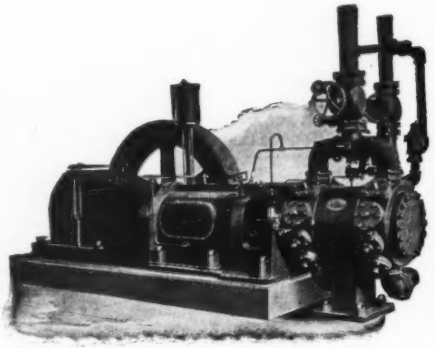

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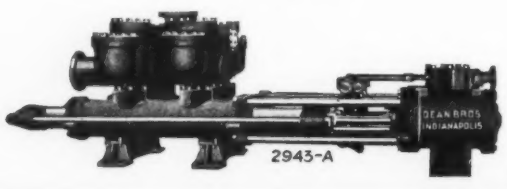
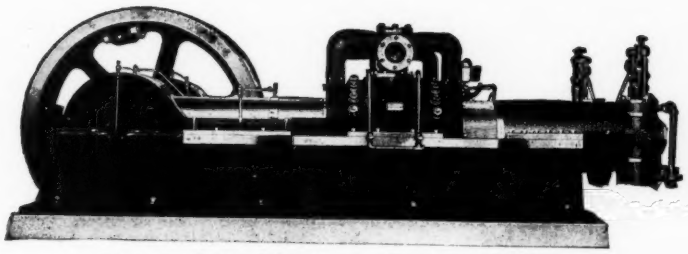


Baltimore, Md. — Davison Chemical Company is understood to have closed a contract with the Pan-American Petroleum Company for the use by the latter of the Silica-Gel process for refining oils. It is reported the Benzol Association of Great Britain is interested in the process.

New York, N. Y.—By October the peak of the California production may be reached, in the opinion of Richard Airey, an executive of the Royal Dutch-Shell, who sailed the first part of September. "I think the high production and low price of oil will continue to the end of the year," he said.

THE NEW ENCLOSED TYPE



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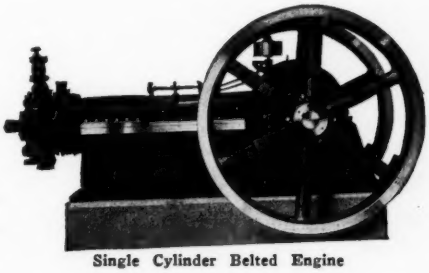
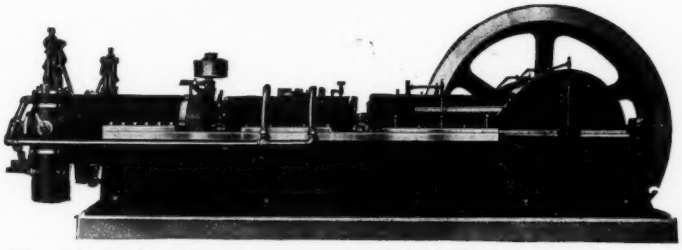
Sizes from 50 to 400 h. p.



Single Cylinder Belted Engine



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	Sept. 10
Soda Ash light 58%.....cwt.	$1.75–2.10
Silicate of Soda 60 deg., bbls., cwt	–2.00
Sal Soda wks.....cwt.	1.10–1.30
Caustic Soda 76%.....cwt.	3.20–3.30
Chloride of Lime solid .....cwt.	1.25–1.50
Sulphuric Acid 60 deg. tank cars f. o. b. shipping point....per ton	–11 00

***Benzol—**

	Sept. 10
Pure Water White.....Tanks....gal	—.27
Drums...gal.	—.32
90% .....Tanks...gal.	—.25
Drums...gal.	—.30

Jobbers' Supplies

Vegetable Oils—

*Linseed, carloads Spot .....gal.	.88– .92
September .....gal.	– .87
October .....gal.	.82– .85
Nov.-Apr. .....gal.	– .80
Less carload Spot .....gal.	.91– .95
5 bbls. or less Spot .....gal.	.95– .98
Boiled, tank Spot.....gal.	– .87
Boiled, carloads Spot .....gal.	.91– .95
Soya Bean Spot, Tanks.....lb.	.09¼

Animal Oils—

English Degras .....lb.	$–.03¾
Domestic Degras, bbls, carloads, ...lb.	–.04
Horse .....lb.	–07½

Oleic Acid—

Dist. .....lb.	–.09¾
Saponified .....lb.	–.09¾

Lard Oils—

Prime Winter Strained . 1 to 1½ffa. 40/45c. t. lb.	$.14¾
Extra Winter Strained . 2 to 4½ffa. 40/45c. t. lb..	12¾
Extra . .... 4 to 5 ffa. 40/45c. t. lb.	.12
Extra No. 1.. 7 to 10 ffa. 40/50c. t. lb.	.11¼
No. 1 .....15 to 18 ffa. 40/45c. t. lb.	.11
No. 2 .....22 to 23 ffa. 40/45c. t. lb.	.10¼
Prime Edible Tallow under 1⅞ffa. 40/45c. t. N. Y. .....lb.	–.08¾
Tallow asidless .....lb.	–.10¼
Lard Stearine .....lb.	–.14¾
Oleo Stearine .....lb.	–.11¾

Neatsfoot Oil—

Pure .....bbls.–lb	13¼
Extra .....bbls.–lb.	11¼
No. 1 .....bbls.–lb.	11
Cold pressed .....lb.	15½

Fish Oils—

Menhaden Oil Light pressed .....gal.	$ –.65
White .....gal.	–.70
Yellow bleached .....gal.	–.69
*Herring, tank cars coast .....gal.	–.40
Whale, extra winter bleached....gal.	.81
Seal	Nominal

Naval Stores—

Turpentine, N. Y. .....gal.	.95
Turpentine† .....gal.	.88½
Rosin B. N. Y. .. ..Bbl.	5.75
Rosin F. N. Y. .....Bbl.	5.90
Rosin B.† .....Bbl.	4.47½
Rosin F.† .....Bbl.	4.47½
Rosin Oil 1st run.....gal.	.42
Rosin Oil 2nd. run .....gal.	.48

Pine Tar—

Kiln Burnt .....Bbl.	11.00
Retort .....Bbl.	11.00

†Savannah, Ga. market.
‡Carlots.
*Nominal.

Magnolia Increases Capacity At Desdemona-Gorman Plant

Desdemona, Texas.—The natural gasoline manufacturing plant operated by the Magnolia Petroleum Company on the W. G. Westmoreland lease in the Desdemona-Gorman field has recently been increased to a daily capacity of 3,000,000 cubic feet of gas with four compressor units. Late in July Magnolia purchased two producing leases in the northwest extension of the field, and shortly afterwards placed orders for five Ingersoll-Rand vacuum pumps to obtain the gas from these newly acquired leases for the plant. It is also reported that Magnolia will add another unit shortly.

The Reeves Vertical Gas Engine-Compressors for Gas Booster Plants

A few of the reasons why leading companies and engineers are purchasing the Reeves Gas Engines and Compressors.

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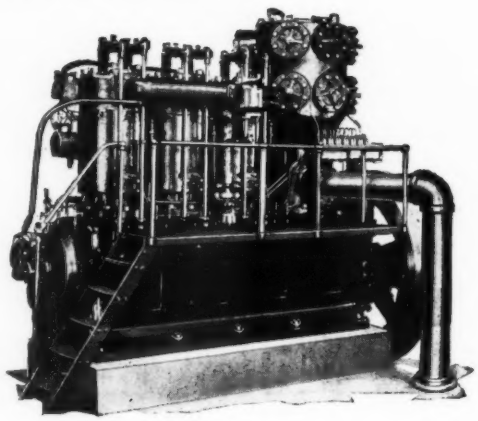
Account of the simplicity of operation; low fuel and maintenance cost per horse power. One user just reported having operated last four units 16 months without shutdown.

All Compressors equipped with "Hope" Biplane, Patented, easy operating, high speed Valves.

Saving in installation time partly pays for unit.

Saving in plant construction cost from 20 to 50 per cent depending on location.



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Engine-Compressor Sizes:
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Representing the great majority of Western Refining interests meeting—
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Mid-Continent Oil and Gas Association
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Purchasing Agents' Association
Convention of Purchasing Agents Ass'n. District No. 7
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Association of Natural Gasoline Manufacturers
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